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BRITISH FERN GAZETTE

VOL. 9

1959-67

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THE BRITISH FERN GAZETTE

VOL. 9 and supplement 1959—1967

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THE

BRITISH FERN GAZETTE

NEW SERIES

VOL. 9 DECEMBER 1959 PART 1

Editorial

An interest in fern variation has been foremost in this Society from its beginning and this interest has in latter years resulted in two factions. One is the fern grower who is anxious to find new and attractive varieties for his collection; the other is the taxonomist, equally interested in finding varieties, but who is interested also in the conditions under which the plant is growing and its possible relationships to other varieties and other species. It is obvious that these interests have more in common than is at first supposed and it is hoped that this will be realised in future activities of the Society.

The *Gazette*, on the other hand, should reflect the aims of the Society and, as the Committee agreed to a widening of these to include fern allies and ferns from all parts of the world, an attempt to do this is made in this issue. The *Gazette* is also, however, the organ of the Society through which members may make contact with each other and I shall be pleased to hear of notes, views, or requests for information for inclusion in the next issue. The previous editor, the Rev. E. A. Elliot, has emphasised this in the past and the Society is indebted to the work he has put into the *Gazette* during the last ten years. We trust his illness will be short and that shortly he may again contribute to the *Gazette*.

SOME NOTES ON VEGETATIVE CHARACTERS OF FERNS

R. E. HOLTTUM
Kew, Surrey

The classification of ferns on the sole basis of shape of sori resulted in an arrangement which in many cases was clearly unnatural.. For example, the Beech Fern and the Oak Fern were placed in the genus *Polypodium*, though they show little other resemblance to *Polypodium vulgare*. Such cases indicate that sori of similar shape have arisen on different evolutionary lines among ferns. If we are to discover a natural classification, we must look at other characters besides the shape of the sorus and of the indusium.

The detailed structure of a single sporangium may provide important evidence, but to observe this requires fairly high magnification and much practice in learning to see clearly the significant details. There are other characters more easy to observe which may be equally significant; and these characters also afford means of distinguishing between genera when plants lack sporangia. The object of the present article is to call attention to some of these characters which are not normally mentioned in works on the taxonomy of ferns. The parts concerned are: vascular strands in the leaf-stalk or stipe; shape of rachis and the way branches and leaflets are attached to it; hairs and scales. In the discussion which follows, generic names used are those found in Hyde & Wade's book on Welsh ferns.

Vascular bundles in the stipe. In the genera *Dryopteris* and *Polystichum* there are several bundles throughout the stipe (at least three, even in small plants) and each bundle is more or less circular in section; there are always two, on the side towards the apex of the rootstock, which are larger and more complex in structure than the rest.

In the genera *Athyrium*, *Asplenium*, *Gymnocarpium** and *Thelypteris* there are two vascular bundles at the base of the stipe, and in most cases these unite in the upper part of the stipe. In *Asplenium* the united strand so formed is X-shaped in section; in *Athyrium* and *Thelypteris* it is U-shaped; in *Gymnocarpium* the two bundles are separate throughout the stipe. This similarity between *Athyrium* and *Thelypteris* is one reason why these two genera have been regarded by some botanists as closely allied; but in my view other characters showing differences between the two genera outweigh this similarity, and I do not think *Athyrium* and *Thelypteris* are at all near to each other (cytological evidence supports this opinion).

Asplenium and *Athyrium* were formerly thought closely related, because of the tropical genus *Diplazium* which appears to bridge the gap between them, and Hooker united all in one genus *Asplenium*. The arrangement of the vascular bundles in the stipe is one constant difference between the genera, and there are others; I believe that the linear sorus in *Asplenium* and *Athyrium* (with *Diplazium*) evolved from different origins. A difference between the two genera given in the *Flora of the British Isles*, by Clapham, Tutin and Warburg appears to me however of doubtful validity. Under

* This is included in *Thelypteris* in Dandy, *List of British Vascular Plants*, 1958.

Athyrium we read " sori borne on receptacles with a vascular strand branched off from the vein "; under *Asplenium* " sori borne direct on the vein." This statement about *Athyrium* was due originally to Mettenius, who wrote it just a century ago, but we have no illustration to show exactly what he meant. I have examined a leaflet of *Athyrium* cleared to show the vascular tissue, and I cannot see the structure mentioned by Mettenius; at any rate it is not one which can be easily observed.

Shape of rachis and of rachis-junctions. In *Athyrium filix-femina* all branches of the rachis are grooved on the upper surface, and the midrib of each leaflet is also grooved; where a smaller rachis joins a larger one, the groove of the larger is opened to admit the smaller, and this also occurs where the groove of a midrib joins the rachis bearing the leaflet. This is true also of *Dryopteris* and *Polystichum* (and of Bracken); but *Thelypteris* has quite a different structure. In *Thelypteris* the rachises and midribs of leaflets are not deeply grooved on the upper surface, and even if they are slightly grooved, the groove of a main rachis is not interrupted to admit that of a branch. In *Gymnocarpium* the fact that the branches are all jointed to the main rachis complicates the situation; but at least one can see that all rachises are grooved in much the same way as in *Athyrium*, *Dryopteris* and *Polystichum*. This is a small piece of evidence pointing to a relationship of *Gymnocarpium* to *Dryopteris* rather than to *Thelypteris*. In the genus *Asplenium*, of which there is an enormous number of tropical species, the shape of the rachises and their branches is more variable, but in the other genera mentioned the shape is very constant and is, I believe, an important generic character.

Scale and hairs. The British species of *Thelypteris* have needle-shaped hairs on their fronds (*T. palustris* also on the rhizome); these hairs each consist of a single cell. *T. oreopteris* has also unicellular yellow glandular hairs on the lower surface of its leaflets; it shares this character with some species of the mountains of the Malayan region (e.g., *T. viscosa*). All species of *Thelypteris*, and of the allied genus *Cyclosorus* (mainly tropical) have unicellular hairs of one form or another, and in this they differ from *Dryopteris* and *Athyrium*. The *Thelypteris* group of ferns have scales which protect the growing tip of the rhizome or rootstock, and these scales also bear unicellular hairs. Such hairs can easily be seen on the edges of the scales of the Beech Fern, *T. phegopteris;* but if the scales of *T. palustris* and *T. oreopteris* are examined with a hand lens, they appear to lack hairs. Microscopic examination shows that there are small round unicellular outgrowths from these scales, comparable to the glandular hairs on *T. oreopteris*. The scales of *Gymnocarpium* differ from those of *Thelypteris* in lacking superficial hairs.

The scales of *Asplenium*, when seen under a low power of the microscope, show an elegant lattice-like pattern. Like nearly all scales of ferns, these scales consist of a single layer of cells. The walls of contact between adjacent cells of this layer are thick and dark, but the upper and lower walls of the cells are thin and transparent, so that each cell is like a little window-pane set in a dark frame. *Athyrium* scales have all walls of about the same thick-

ness and colour, so that they show no lattice-pattern; this is another difference between all species of *Athyrium* and *Asplenium*.

The scales of *Dryopteris*, *Polystichum* and *Gymnocarpium* are alike in essentials. In some species of *Dryopteris* and *Polystichum* there are hairs on the edges of some scales, but these hairs are not needle-like nor round as in *Thelypteris*, nor are any of them borne on the surface of the scales.

Polypodium vulgare is so different from all other British ferns that it needs a separate note. The vascular strands in the stipe are three, or sometimes more (two larger than the rest, as in *Dryopteris*), each strand more or less circular in section. The frond has no separate leaflets, as in the other genera; its midrib is raised, not grooved, on the upper surface. At the base of the frond, the edges of the leafy part run down each side of the stipe as a little ridge. This arrangement is also found in ferns of some other (non-British) genera which are not closely related to *Polypodium*. The veins in the frond of our British *Polypodium* are free; but in almost all the many tropical ferns to which it is allied the veins form an elaborate network; our species is a reduced outlier of a mainly tropical family, almost all members of which are epiphytes. The rhizome of *P. vulgare*, as in all its family, is creeping and is dorsiventral in structure (that is, its vascular anatomy has definite upper and lower sides); our other ferns which have slender creeping rhizomes (*Thelypteris palustris*, *T. phegopteris* and the two species of *Gymnocarpium*) have an internal structure which is not dorsiventral. The scales of *P. vulgare* are uniformly light brown, the cells not forming a clear lattice-work. There are no unicellular hairs on either frond or scales.

A PRELIMINARY CENSUS LIST OF BRITISH PTERIDOPHYTES

A. C. JERMY

British Museum (Natural History)

In 1932 George Claridge Druce published his *Comital Flora of the British Isles* in which 70 species of Pteridophytes were included together with their distribution known at that time. In order briefly to summarize this distribution Druce used the counties and vice-counties drawn up for England, Wales and Scotland by H. C. Watson[13] and for Ireland by R. L. Praeger[11]. These divisions do not always agree exactly with present administrative county boundaries. Further particulars as to the divisions of the larger counties can be obtained from the references above or from the *Census Catalogue of British Hepatics, Ed. 3.*[15] The advantages and difficulties in this system have been discussed by Dandy[5] and Lousley[10] and will not be taken up here.

The present paper uses the vice-county system and is not intended to be final in anyway as it is hoped that the end of 1961 will see published an *Atlas* showing the distribution of British vascular plants on a 10-kilometre grid-square basis. This will be the result of a scheme launched by the Botanical Society of the British Isles to which many members of the B.P.S. will have

contributed. However, records are still needed and there are many records in literature and in herbaria which need confirming in the field; there are vice-counties from which some ferns have not been seen in the last 30 years yet their habitats remain, although decreased in area. Such vice-counties are put in ( ). In other cases the identification or the locality is dubious and the record of a species in a vice-county in [ ] needs confirming. Lastly there are vice-counties where the introduction of a species has been affected by man either by planting or by providing artificial habitats; such vice-counties are denoted by an *. The arrangement and the nomenclature of species follow that of Dandy[6] with two changes approved by him; a key to the vice-county numbers is appended at the end of this paper.

I would like to thank all who have helped in this compilation, in particular Dr. K. L. Alvin for the *Isoetaceae* records, and Mr. D. H. Kent and Dr. F. H. Perring, Director of the B.S.B.I. Maps Distribution Scheme, for their co-operation.

LYCOPODIACEAE

1 LYCOPODIUM L.

1 **L. selago** L. **Fir Clubmoss**

Native. Heaths, moors, mountain grassland and rock ledges; rarely lowland.
1–6, [7], (8), 9–14, [15], 17, 22, 23, [24], 27, 33, 34, 36, [37, 38], 39, 40, [41], 42–50, 52, [54], 55–60, 62–83, 85–112; H1–40.

2 **L. inundatum** L. **Marsh Clubmoss**

Native. Wet heaths in lowland areas, local.
1–5, 8, 9, 11–19, 21, 22, 24–31, 37–39, 48, [49], 54–59, 61–63, 69, 70, 75, 85, 87–92, 95–97, 99, 100, 104–106, 108, 111; H2, 3, 16, 18, 20, 27.

3 **L. annotinum** L. **Interrupted Clubmoss**

Native. Moors in mountain areas, local.
(49), [55, 59], 62, [66], 69, 70, 72, [78], 88–92, 94–98, [100, 103], 104–107, [109], 111.

4 **L. clavatum** L. **Stag's Horn Moss, Common Clubmoss**

Native. Heaths, moors and grassland in mountain areas; rarely lowland.
1–6, [7], 9–18, 20–24, 26–30, 32, 34–52, 54–81, 83–100, 103–106, 108–112; H2–6, 10, 11, 13, 15–18, 20, 21, 24, 25, 27, 28–31, 33–40.

5 **L. alpinum** L. (*L. complanatum* auct.; *L. issleri* (Rouy) Lawalrée). **Alpine Clubmoss**

Native. Moors, mountain grassland, usually above 2,000 ft.
[3], (4, 5, 12, 34, 37, 42), 43–46, (47), 48–50, [51], (54*), [55], (57), [58, 59], 60, (62–66), 67–70, (71), 72, 73, [74], (75, 76), [77], (78), [79], (80), 81, (83), 86–92, (93, 94), 95–99, (100), 101, [102, 103], 104–109, [110], 111, 112; H (1, 2, 16), 20, (21), 27, [28], 29, (34), 35, 36, 38–40.

SELAGINELLACEAE

2 SELAGINELLA Beauv.

1 **S. selaginoides** (L.) Link **Lesser Clubmoss**

Native. Amongst moss or in short turf mainly in hilly districts.
[17], 48–52, 54, 57–83, 85–112; H3, 9–40.

2 **S. kraussiana** (Kunze) A. Braun

Introduced. Escapes from greenhouse cultivation and has become established in a few places.
0, 1, 3, 24, 104; H3.

ISOETACEAE

3 ISOETES L.

1 **I. lacustris** L. **Quillwort**

Native. In lakes and tarns with varied substrate, usually poor in dissolved salts.
[3], 40, (41), [42], 44, 46, [47], 48, 49. [50, 51], 52, (61), 67, 69, 70, (72–74), [75], 79, [85], 86–90, 92, [94], 95–112; H1 (2, 3, 6), [9], 16, 20, (25), 27, 29, 30, 32–36, (37), 38, 39, (40).

2 **I. echinospora** Durieu **Quillwort**

Native. In lakes and tarns, usually on peaty substrate.
2, 3, 9, 41, 46, 48, 49, [51, 87], 88, [91], 92, 93, 96, [97,] 98, 99, 103–105, [107], 108, 110, 112; H1, 2, 9, 16, 27, 35.

3 **I. histrix** Bory

Native. In peaty and sandy places with a high winter water-table.
On Guernsey and Alderney, v.c.0, and on the Lizard, v.c.1.

EQUISETACEAE

4 EQUISETUM L.

1 **E. hyemale** L. **Rough Horsetail**

Native. Shady stream banks, damp woods.
[4], (6), 11, (14), [15], (17), [21], (26, 27, 29, 30, 36–39), [40], 41, [50, 51]. 54, (55), [56], (58), [59]. 60–70, 72, 73, 75, 77, 81, 83, 84, [87]. 88–97, 104, 106, 108, 109; H1, (2, 4, 9), [11], 12, (13–15. 18. 19), 20, 21, 28, (29, 31, 33, 35), 36, (38), 39, (40).

E. × **trachyodon** A. Braun (*E. hyemale* × *E. variegatum*)

Native. Shady marshy banks by streams.
59, 64, 88. 90–92, [103]; H1, 2, 4, 9, 14–16, 21, 26–28, 33–36, 38–40.

2 **E. moorei** Newm. (*E. occidentale* (Hy) Coste)

Native. Dunes and banks by the sea, rarely inland.
17, 88, 92; H2, 12, 20.

3 **E. ramosissimum** Desf.

Probably native; first found in 1947.
Only one station by the R. Witham, near Boston, S. Lincoln, v.c.53.

4 **E. variegatum** Schleich. ex Weber & Mohr **Variegated Horsetail**

Native. Dune-slacks, wet banks and flushes on mountains.
3, 4, (6), [20], 22, 41, [42], 44–46, 48, 49, 51, 52. 58–60, 64–66, (67), 68–70, (71, 77, 82), 85, (86), 88–90, (91), 92, 93, 98, [100], 104, 106, 108, 110; H1, (2, 8), 9, 13, 14, (15, 16), 17, (18), 19–25, (26), 28, (29), 33, 36, 40.

5 **E. fluviatile** L. (*E. limosum* L.) **Water Horsetail**

Native. In shallow water at the edges of lakes, ponds and in ditches.
In all vice-counties except Monmouth, v.c. 35 and Montgomery, v.c.47.

6 **E. palustre** L. **Marsh Horsetail**

Native. In most wet habitats from open shallow water to wet woods and mountain flushes.
In all vice-counties except Montgomery, v.c.47.

7 **E. sylvaticum** L. **Wood Horsetail**

Native. Damp woods and moors, usually on acid soils.
1, 2, 4–6, (7), 8–24, [25], (26), 27, 28, (29, 30), 32–51, 53–60, 62–112; H1–18, 20, 21, 24–40.

8 **E. pratense** Ehrh. **Shady Horsetail**

Native. Wet grassy stream banks in hilly districts.
[59], 65, 66, (68, 69, 72), 75, (77), [78], (83–87), 88–90, (91), 92, [94], 95, 96, 98, [104], 107–110, (111); H33, (34, 35), 39.

9 **E. arvense** L. **Common or Field Horsetail**

Native. Fields, in sandy soil, often in wet areas e.g., flushes, etc.
Widespread in all vice-counties.

E. × **litorale** Kühlew. ex Rupr. (*E. arvense* × *E. fluviatile*)
Native. Occurs with parents quite frequently.
2, 5, 6, 8, 12, 14, 16, 17, 22, 48, 53, 54, [59], 69, 88, 90, 107; H. 1–3, 35, 38.

10 **E. elmateia** Ehrh. (*E. maximum* auct.) **Giant Horsetail**

Native. On shady banks often in heavy soil.
0, [1, 2], 3, [4], 5–46, 46–71. 73–77, 81, 83, [84, 85, 90–92], 98–102, 104 105, 108, [111]; H1–40.

OSMUNDACEAE

5 OSMUNDA L.

1 **O. regalis** L. **Royal Fern**

Native. Fens, bogs, wet heaths and wet woods (carr) on peaty soils.
0, 1–7, (8), 9–19, 21–28, (29, 30, 32), [30], (34), 35–52, 54, (55), 56–78, 81, 82, 84–88, 91, 93–95, 97–105, 108–110, 112; H1–31, 32*, 33–40.

HYMENOPHYLLACEAE

6 TRICHOMANES L.

1 **T. speciosum** Willd. (*T. andrewsii* Newm.; *T. radicans* auct.) **Bristle-fern**

Native. In dark rock crevices, and under and by waterfalls.
48, (49), 63*, (64, 69), 98, 100. [101]; H1, (2), 3, (4, 5. 6), 8, (9, 10), 13, (20), 28, (33), 35, (36), 39.

7 HYMENOPHYLLUM Sm.

1 **H. tunbrigense** (L.) Sm. **Tunbridge Filmy-fern**

Native. On rocks and tree trunks in moist and shady places.
(1, 2), 3, (4), 5, [6], 14, (16), [36, 39], 41, (42), 44, 46, 48, 49, [52, 57, 58, 59], (60, 62, 63, 64, 68), [69], 70, (72, 76, 77), [78], 86, (97), 98–102, (103), 104, [105]; H1–3, (4–6), 8, (9–12), 16, (24, 25), 27, (28), 29–31, 33, (35) 36. 37, (39).

2 **H. wilsonii** Hook. (*H. peltatum* auct.; *H. unilaterale* auct.) **Wilson's Filmy-fern**

Native. Habitat as in *H. tunbridgense* but often in more exposed situations.
1, (2, 3), 4, [9], (39), [40], 41, (42), 43–49, (50), [52, 59], (60), 62–65, 67–73, [74], 75, 76, 78, [80], (85), 86–90, 92, 97–105, 108, [109], 110–112; H1–3, 6, 7, (8, 9, 12–15), 16, 20, (21, 25, 26), 27, (28–31), 33–36, 38–39 (40).

DENNSTAEDTIACEAE

8 PTERIDIUM Scop.

1 **P. aquilinum** (L.) Kuhn (*Pteris aquilina* L.) **Bracken**

Native. Woods, heaths, mountain grassland, etc., usually on light acid soils. Widespread in all vice-counties.

ADIANTACEAE

9 CRYPTOGRAMMA R.Br.

1 **C. crispa** (L.) R. Br. ex Hook. (*Allosorus crispus* (L.) Röhl.) **Parsley Fern**

Native. Screes, rocky slopes and walls; in hilly areas on acid soils.
(5*, 37), [40], (41), 42–44, 46–50, (57, 58), [59], 60, (62, 63), 64–73, [74], 75, (76, 77), 78, 79, (80), 81, [83], 85–88, (89), 90, [91], 92, [93–95], 96-99, (100), 101, 103–106, 108, [109], 110; H20, 30, 31, 33, 35, 38–40.

10 ANOGRAMMA Link

1 **A. leptophylla** (L.) Link (*Gymnogramma leptophylla* (L.) Desv.)

Native. Shaded banks. Only in Jersey and Guernsey, v.c.0.

11 ADIANTUM L.

1 **A. capillus-veneris** L. **Maidenhair Fern**

Native. Damp crevices in calcareous rocks usually near the sea.
0, 1–4, 6*, 8*, 9, [11*], 13*, [15], 17*, [29], 36*, 38*, [39, 40], 41, [48, 49], 53, [57, 59], 64*, (69), 71, [91, 100]; H9, 16, [17], 27–29, 30*, 35.

BLECHNACEAE

12 ONOCLEA L.

1 **O. sensibilis** L. **Bead Fern, Sensitive Fern**

An alien. Occasionally grown in bog gardens and has been reported from swampy ground in N. Hants., v.c.12, and on the edge of Rydal Water, v.c.69.

13 BLECHNUM L.

1 **B. spicant** (L.) Roth (*Lomaria Spicant* (L.) Desv.) **Hard Fern**

Native. A calcifuge of woods, heaths, moors, mountain grassland, etc.
Found in all vice-counties.

ASPLENIACEAE

14 PHYLLITIS Hill

1 **P. scolopendrium** (L.) Newm. **Hart's-tongue Fern**
(*Scolopendrium vulgare* Sm.)

Native. In shady hedgebanks and walls and in rocky woods.
In all vice-counties *except* 82, 84, 106, 107.

15 ASPLENIUM L.

1 **A. adiantum-nigrum** L. **Black Spleenwort**

a subsp. **adiantum-nigrum**

Native. On rocky banks, ledges and walls.
Found in all vice-counties but less common in E. England.

b subsp. **onopteris** (L.) Luerss.

Native. On rocky outcrops more often of ultrabasic rocks.
1, 90, 92, 93; H1–5, [8], 9, 11, [16], 20, [26], 27, 38.

2 **A. obovatum** Viv. (*A. lanceolatum* Huds. *pro parte*) **Lanceolate Spleenwort**

Native. Rocky places and walls usually near the sea.
0, 1–5, [9], 14, [15], 16, [23], 34, [40], 41, [42], 44, [45], 48, 49, 59, 62, 63, [64], 70, (71), 101; H1, 3, 4, 12, 13, 20.

A. refractum T. Moore (*A. obovatum* × *A. trichomanes*)

Native. Found by Moore at Pepperharrow Park, Surrey, v.c.17.

3 **A. fontanum** (L.) Bernh.

An escape, occasionally found on walls.
11, 12, [17], 24, 68.

4 **A. marinum** L. **Sea Spleenwort**

Native. Crevices and ledges of cliffs and rocks by the sea.
0, 1–5, (6), 9, (10, 14), [15], 41, 44–46, 48, 49, [50], 51, 52, 58, 59, (60), 62, 66–76, (81, 82), 85, 90–92, (93), 94, 95, 97, 98, [99], 100–112; H1, (2), 3–6, (8), 9, 11, 12, 16, (20), 21, 27–29, 34, 35, 38–40.

5 **A. trichomanes** L. **Maidenhair Spleenwort**

Native. On walls and rock crevices of usually basic rocks.
In all vice-counties but the Orkney (v.c.111) record needs more recent confirmation.

6 **A. viride** Huds. **Green Spleenwort**

Native. As in *A. trichomanes* but prefers more basic rocks.
[3, 13, 15, 17, 21, 27], 35, 36, (37), [38], 39, 41, 42, 44, 48–50, [55], 57, [58, 59], 60, (62), [63], 64–67, (68), 69, 70, 72, 73, 75–78, 80, [83, 84], 85–90, 92, 94–101, [103], 104, 105, [106], 107–110, 112; H (1–3, 6), 7, 8, 16, (27), 28, (29), 33, (34, 35).

7 **A. ruta-muraria** L. **Wall Rue**

Native. Walls and mainly basic rocks.
Throughout the British Isles.

A × **clermontiae** Syme (*A. ruta-muraria* × *A. trichomanes*)

Found once on a wall in Louth, v.c.H31.

A. × **murbeckii** Dörfl. (*A. ruta-muraria* × *A. septentrionale*; *A. ruta-muraria* var. *cuneatum* T. Moore)

Once found near Dunkeld, E. Perth, v.c.89.

8 **A. septentrionale** (L.) Hoffm. **Forked Spleenwort**

Native. Crevices in rocks and occasionally on walls.
3–5, (15, 17), [45], 47–49, [50], 67–70, [78], 80, 83, [85], 89, [90], 92, 97, 104, 105.

A. × **alternifolium** Wulf. (*A. septentrionale* × *A. trichomanes*; *A. germanicum* auct.; *A. breynii* auct.)

Native. Crevices in rocks with the parents.
5, [42], 48, 49, 68–70, 80, 83, 85, 89, [90].

× **ASPLENOPHYLLITIS** Alston (*ASPLENIUM* × *PHYLLITIS*)

× **Asplenophyllitis jacksonii** Alston (*A. adiantum-nigrum* × *P. scolopendrium*)

Found with parents in Jersey and Guernsey, v.c.0, and at Hartland, E. Cornwall, v.c.2.

× **Asplenophyllitis microdon** (T. Moore) Alston
(*A. obovatum* × *P. scolopendrium*)
Found in Guernsey, v.c.0, and Penzance, W. Cornwall, v.c.1.

× **Asplenophyllitis confluens** (Lowe) Alston
(*A. trichomanes* × *P. scolopendrium*)
Found occasionally with parents.
62, 70; H2.

16 CETERACH DC.

1 **C. officinarum** DC. (*Asplenium ceterach* L.) **Rusty-back Fern**

Native. On walls and calcareous rocks and soil.
0, 1–24, 26, 27, 30, 32–52, 56–60, [61], 62–65, 68–77, 81, [82, 86], 88, 89, 98–101, [102], 103; H1–40.

ATHYRIACEAE

17 **MATTEUCCIA** Tod.

1 **M. struthiopteris** (L.) Tod. **Ostrich Fern**

Naturalised in damp ground and in woods in a few places.
13, 88, 89; H39.

18 **ATHYRIUM** Roth

1 **A. filix-femina** (L.) Roth **Lady-fern**

Native. In woods, on heaths, damp gullies, etc.
In all vice-counties.

2 **A. alpestre** Clairv. *sensu lato* **Alpine Lady-fern**
(*Aspidium alpestre* (Hoppe); *Polypodium alpestre* (Hoppe) Spenn.)

1 **A. alpestre** Clairv. (*Polypodium molle* All., *non* Schreb.)
Native. In shady places amongst alpine rocks and by mountain stream sides.
[86, 87], 88, [89], 90, 92, [94], 96–98, 105, 106, [107], 108; [H34, 35].

2 **A. flexile** (Newm.) Druce
(*Polypodium flexile* (Newm.) T. Moore, *non* Fée; *Athyrium alpestre* var. *flexile* (Newm.) Druce.)
Native. High alpine corries.
88, 90, 94, 96–98, [108].

19 **CYSTOPTERIS** Bernh.

1 **C. fragilis** (L.) Bernh. **Brittle Bladder-fern**
(*C. dentata* (Sm.) Desv.; *C. regia* (L.) Desv.; *C. alpina* (Roth) Desv.)
Native. Shady rocks and ledges; occasionally on man-made walls.
0, 1–9, [11], 12 [13–16]. 17, [18, 19], (20*), 21–23, [25], 26, 27*, 30, 32–44, 46–52, 54–60, 62–112; H1–3, 6–11, 13–17, 19, 20, 22–30, 32–40.

2 **C. dickieana** Sim

Native. In dark and wet rock clefts. First found in Kincardine.
[71], 88, 90, 91.

3 **C. montana** (Lam.) Desv. **Mountain Bladder-fern**

Native. In damp situations usually on basic rocks.
[49], (69), [70], (86), 88, 90, (92), [94], 97, 98, 101, [104].

20 **WOODSIA** R.Br.

1 **W. ilvensis** (L.) R.Br. **Oblong Woodsia**

Native. Crevices in rock faces and rock ledges above 1,200ft.
[48], 49, [65], 66, 69, 70, 72, [88], 90, [103].

2 **W. alpina** (Bolton) Gray **Alpine or Round-leaved Woodsia**
(*W. hyperborea* (Lilj.) R.Br.)

Native. Rocky crevices on mountains from 1,900ft. to 3,000 ft.
49, 88, [89], 90, [104].

ASPIDIACEAE

21 **DRYOPTERIS** Adans. (*NEPHRODIUM* Michx.)

1 **D. filix-mas** (L.) Schott **Male Fern**
(*Aspidium filix-mas* (L.) Sw.; *Nephrodium filix-mas* (L.) Strempel; *Lastrea filix-mas* (L.) C. Presl)

Native. Woodlands, hedgebanks, mountain slopes, etc.
Widespread throughout the British Isles.

D. filix-mas × **D. lanceolatocristata** (*D. remota* Druce *pro parte;* *Aspidium remotum* auct.; *Lastrea remota* auct.)

Native. Occurs occasionally with the parents.
[35], 69, [99]; H15.

2 **D. borreri** Newm.

Native. In similar situations to *D. filix-mas.*
0, 1–11, 13–19. 25, 27, 30, 31, 33–36, 38, 40–42, 44–50, 53, 54, 56, 57, **60**, 62–75, 77, 78, 80, 82, 83, 85–92, 94–101, 104–106, 108, 111; H1–4, 7–9, **12**, 15, 16, 20, 22, 27–29, 33, 35, 36, 38, 40.

D. × **tavelii** Rothm. (*D. borreri* × *D. filix-mas*)

Native. In similar situations as parents.
2, 3, 8, 9, 35, 36, 69, 85, 94.

D × **woynarii** Rothm. (*D. borreri* × *D. dilatata*)

Presumably native. Has been found by the side of Loch Lomond, Dumbarton, v.c.99.

3 **D. abbreviata** (DC.) Newm. (*Lastrea propinqua* Wollaston *non* J.Sm.)

Native. On screes, etc., in drier situations than previous two species.
9, 14, 34, 35, 40, 49, 54, 64, [65], 66, 69, 70, 72, 77, 87–90, 92, 97, 98, 101–105, 108, 110; H11, 38.

4 **D. villarii** (Bellardi) Woynar **Rigid Buckler-fern**
(*Aspidium rigidum* Sw.; *Lastrea rigida* (Sw.) C. Presl)

Native. In clefts in limestone pavement.
[6], 49, 50, 60, 64, 65, 69, 70, [100]; H31*.

5 **D. cristata** (L.) A. Gray **Crested Buckler-fern**
(*Aspidium cristatum* (L.) Sw.; *Lastrea cristata* (L.) C. Presl)

Native. On wet heaths and in reed-beds and marshes.
[3, 8, 9], 10, 15, 17, 23, 25, 27, 28, [38], 31, [37], 39, 56, 58, 61–64, 74–76, [84, 92].

D. × **uliginosa** (Newm.) Kuntze ex Druce (D. *cristata* × *D. lanceolatocristata;* *Lastrea uliginosa* Newm.)

Native. On wet heaths and shaded marshes.
15, [18, 24, 25], 27–29, 36, 38–40, 56–58, 62, 85, [91]; H2.

6 **D. lanceolatocristata** (Hoffm.) Alston **Narrow Buckler-fern**
(*Aspidium spinulosum* Sw.; *Lastrea spinulosa* C. Presl; *Dryopteris spinulosa* Watt)
Native. Damp woods, marshes, wet heaths.
1–22, [23], 24–42, 44, 46, 48, 49, 51–76, [77], 78–81, [83], 85–92, 94–106, 108, 110; H1–11, 13–20, 21–40.

7 **D. dilatata** (Hoffm.) A. Gray **Broad Buckler-fern**
(*Aspidium dilatata* (Hoffm.) Sm.; *Lastrea dilatata* (Hoffm.) C. Presl; *Dryopteris aristata* Druce, *non* Kuntze; *D. austriaca* auct.)
Native. Woods, hedgebanks, in rock crevices, etc.
Common throughout the British Isles. A small mountain form has been recorded (as var. *alpinum* T. Moore) from: 70, 86, 88–90, 92, 88, 104, 109, 111. Some of these have proved to be the diploid form and more collecting of fertile material is needed.

D. × **subaustriaca** Rothm. (*D. dilatata* × *D. filix-mas*)
Recorded from S. Devon, v.c.3, and from Dalystown, S.E. Galway, v.c.H15.

D. × **deweveri** (Jansen) Jansen & Wachter (*D. dilatata* × *D. lanceolatocristata*)
Native. Occurs frequently with the parents.
Recorded from 2, 6, 14, 17, 18, 27, 34, 36, 40, 61, 63, 69; H15, [22, 23], 34.

8 **D. aemula** (Ait.) Kuntze **Hay-scented Buckler-fern**
(*Aspidium aemulum* (Ait.) Sw.; *Lastrea aemula* (Ait.) Brackenr.)
Native. Woods, shady banks and rocks.
1–5, [6], (8, 9), 14–17, 34, 36, 39, (40, 41), 44–46, (48), 49, [51, 52], 62, (63), 66, 67, (68), 69–71, 74, (75), 76, [80, 81, 89, 90], (92), [96], 97, 98, [99], 100–105, [109], 110, 111; H1–18, 20, (21), 23, 24, 26–40.

22 POLYSTICHUM Roth

1 **P. setiferum** (Forsk.) Woynar **Soft Shield-fern**
(*Aspidium angulare* Kit. ex Willd.; *Polystichum angulare* (Willd.) C. Presl; *P. braunii* auct.)
Native. Woods, banks, hedgerows, etc. on light soils.
0, 1–27, 31–52, 54–71, 73–75, [76, 77], 78, 80–83, 88, 95, 97, 98, [99], 100, 101; H1–40.

2 **P. aculeatum** (L.) Roth **Hard Shield-fern**
(*Aspidium aculeatum* (L.) Sw.; *A. lobatum* (Huds.) Sw.; *Polystichum lobatum* (Huds.) Chevall.)
Native. Woods, hedgebanks, etc.
1–28, (29), 30–52, 54–83, [84], 85–111; H1–3, 5–40.

P. × **bicknellii** (Christ) Hahne (*P. aculeatum* × *P. setiferum*)
Native. Occurs occasionally in mixed populations of the parent species.
Recorded for [1], 4, 12, 22, 39, 59.

3 **P. lonchitis** (L.) Roth (*Aspidium lonchitis* (L.) Sw.) **Holly Fern**
Native. On screes, and in crevices of basic rocks.
23*, [29, 32, 36, 41, 48], 49, 64–66, [68], 69, 70, 72, 86–90, 92, 94, [95], 96–99, [103], 104-108, (109, 111); H1, 2, 16, (27), 28, 29, 34, (35).

23 CYRTOMIUM C. Presl

1 **C. falcatum** (L.f.) C. Presl
An eastern asiatic species often cultivated in the cool house.
Escaped in the Scilly Isles, v.c.1, in Surrey, v.c.17 and possibly elsewhere.

THELYPTERIDACEAE

24 THELYPTERIS Schmidel (*LASTREA* Bory; *GYMNOCARPIUM* Newm.; *PHEGOPTERIS* (C. Presl) Fée)

1 **T. limbosperma** (All.) H. P. Fuchs **Mountain Fern**
(*T. oreopteris* (Ehrh.) Slosson; *Aspidium oreopteris* (Ehrh.) Sw.; *Dryopteris oreopteris* (Ehrh.) Maxon)
Native. In woods and mountain slopes and screes in siliceous areas.
1–27, 33–81, 83, 85–112; H1–3, 6–14, 18, 20. 21, 24, 25, 27–31, 33–40.

2 **T. palustris** Schott **Marsh Fern**
(*Aspidium thelypteris* (L.) Sw.; *Dryopteris thelypteris* (L.) A. Gray).
Native. In fens and marshes; often in wet woods (carr).
[3], 6, (8), 9–11, [12], 13–19, 22, 24–32, 35, 36, 38–41, [43], 44–46, 49, 51, 52, 54, [55], 56, 58, 61–64, 68–70, 88, 90; H2, 9, 15, 17, 19, 20, 22–26, 30, 31, 34, 36, (39), 40.

3 **T. phegopteris** (L.) Slosson **Beech Fern**
(*Polypodium phegopteris* L.; *Phegopteris polypodioides* Fée; *Dryopteris phegopteris* (L.) C. Chr.)
Native. In shady clefts in siliceous rocks.
1–6, (8), 9, 11, 13, 14, 17, 21, 22, 33–36, 39–44, 46–51, 57–112; H1–3, 9, 14, 16, 20, 21, 27–31, 33–40.

4 **T. dryopteris** (L.) Slosson **Oak Fern**
(*Polypodium dryopteris* L.; *Gymnocarpium dryopteris* (L.) Newm.; *Phegopteris dryopteris* (L.) Fée; *Dryopteris dryopteris* (L.) Christ),
Native. In shady places on siliceous rock ledges and in woods.
2–5, [7–9], 11, [13, 14, 18, 19], 22, 23, [24], 26, [33], 34–37, [38], 39–44 [45], 46–50, [51, 52], 54 [56], 57–70, [71], 72, 73, [74], 75–81, 83–101, [102], 103–109, [110], 112; H(9, 20, 28, 29), 39.

5 **T. robertiana** (Hoffm.) Slosson **Limestone Fern**
(*Polypodium robertianum* Hoffm.; *Gymnocarpium robertianum* (Hoffm.) Newm.; *Phegopteris robertiana* (Hoffm.) A. Braun; *Dryopteris robertiana* (Hoffm.) C. Chr.)
Native. Limestone screes and rocks.
6, 7, 13, 17*, 23, 24, 28, 32–37, 39, 45, 47, [49], 50, 57, 59, 60, 62–66, 69, 70, 88, [93]; H[15, 17], 26, [27].

POLYPODIACEAE

25 POLYPODIUM L.

1 **P. vulgare** L. *sensu lato* **Polypody**
Native. Banks, walls, rocks, on mossy tree trunks, etc. Widespread.
This aggregate apparently includes three species and specimens from any locality are needed in order that their distribution may be elucidated.

MARSILEACEAE

26 PILULARIA L.

1 **P. globulifera** L. **Pepper-grass, Pillwort**
Native. On acid soils at the edges of pools, often submerged.
0, 1–3, 5, 6, 8–15, 17, 18, 20–22, 24–28, 31, [32, 33], 45–52, 55, 58, 59, 61, 62, 65, 67, 69, 70, (71), 72–77, 83–85, 87–92, 95, 96, 98, 99, 104, 107, [108], 110; H1, 2, 16, 35, 36, 39, 40.

AZOLLACEAE

27 AZOLLA Lam.

1 **A. filiculoides** Lam.

Introduced. Ditches, canals and other stretches of open water.
[0, 3], 4–9, 11–15, [16], 17, 18, 20–22, (23, 24), 25, 27, (29, 33–35), 37, 38, 53, 55, 58; H5, 31.

OPHIOGLOSSACEAE

28 BOTRYCHIUM Sw.

1 **B. lunaria** (L.) Sw. **Moonwort**

Native. Dry grassland, well drained banks, ledges etc.
1–17, (19, 20), 22–29, (30), 32–112; H1–24, 27–40.

2 **B. lanceolatum** (S. G. Gmel.) Ångstr.

Doubtfully native; found originally on Sands of Barry, Angus, v.c.90 and has also been recorded from v.c.57, 61, 69 and 79. All records need confirming.

3 **B. matricariifolium** A. Braun ex Koch (*B. multifidum* auct.)

Native? Found on sandy sea shore at Stevenston, Ayr, v.c.75 and needs confirming in v.c.69 and 90.

4 **B. multifidum** (S. G. Gmel.) Rupr. (*B. matricariae* (Schrank) Spreng.)

Native? Found on a grass topped wall in Strachan, Kincardine, v.c.91.

29 OPHIOGLOSSUM L.

1 **O. vulgatum** L. **Adder's Tongue**

a subsp. **vulgatum**

Native. Fens, damp meadows, woodsides, etc.
0, 1–77, 79–89, [90], 91, 93–95, 98, 100–103, [104], 105, 108, 110–112; H1–40.

b subsp. **ambiguum** (Coss. & Germ.) E. F. Warb.
(*O vulgatum* subsp. *polyphyllum* E. F. Warb. *pro parte*)

Native. Sandy ground, short turf near the sea.
0, 1, 4, 9, 41, 48, 110–112; H1, 2, 34, 35.

2 **O. lusitanicum** L.

Native. Grassy tops of cliffs.
Channel Isles, v.c.0, and Scilly Isles, v.c.1.

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VICE-COUNTY NAMES AND NUMBERS

Channel Islands

0 Channel Islands

England and Wales

1 West Cornwall
2 East Cornwall
3 South Devon
4 North Devon
5 South Somerset
6 North Somerset
7 North Wilts
8 South Wilts
9 Dorset
10 Isle of Wight
11 South Hants
12 North Hants
13 West Sussex
14 East Sussex
15 East Kent
16 West Kent
17 Surrey
18 South Essex
19 North Essex
20 Herts
21 Middlesex
22 Berks
23 Oxford
24 Bucks
25 East Suffolk
26 West Suffolk
27 East Norfolk
28 West Norfolk
29 Cambridge
30 Bedford
31 Hunts
32 Northampton
33 East Gloucester
34 West Gloucester
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan
47 Montgomery
48 Merioneth
49 Caernarvon
50 Denbigh
51 Flint
52 Anglesey
53 South Lincoln
54 North Lincoln
55 Leicester (with Rutland)
56 Nottingham
57 Derby
58 Chester
59 South Lancaster
60 West Lancaster
61 South-east York
62 North-east York
63 South-west York
64 Mid-west York
65 North-west York
66 Durham
67 Northumberland South
68 Cheviotland
69 Westmorland (with N. Lancaster)
70 Cumberland

Isle of Man

71 Isle of Man

Scotland

72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow
85 Fife (with Kinross)
86 Stirling
87 West Perth (with Clackmannan)
88 Mid Perth
89 East Perth
90 Forfar
91 Kincardine
92 South Aberdeen
93 North Aberdeen
94 Banff
95 Elgin
96 Easterness (w. Nairn)
97 Westerness
98 Main Argyll
99 Dunbarton
100 Clyde Isles
101 Kintyre
102 South Ebudes
103 Mid Ebudes
104 North Ebudes
105 West Ross
106 East Ross
107 East Sutherland
108 West Sutherland
109 Caithness
110 Outer Hebrides
111 Orkney
112 Zetland

Ireland

H 1 South Kerry
H 2 North Kerry
H 3 West Cork
H 4 Mid Cork
H 5 East Cork
H 6 Waterford
H 7 South Tipperary
H 8 Limerick
H 9 Clare
H 10 North Tipperary
H 11 Kilkenny
H 12 Wexford
H 13 Carlow
H 14 Leix
H 15 South-east Galway
H 16 West Galway
H 17 North-east Galway
H 18 Offaly
H 19 Kildare
H 20 Wicklow
H 21 Dublin
H 22 Meath
H 23 Westmeath
H 24 Longford
H 25 Roscommon
H 26 East Mayo
H 27 West Mayo
H 28 Sligo
H 29 Leitrim
H 30 Cavan
H 31 Louth
H 32 Monaghan
H 33 Fermanagh
H 34 East Donegal
H 35 West Donegal
H 36 Tyrone
H 37 Armagh
H 38 Down
H 39 Antrim
H 40 Londonderry

THE GEOGRAPHICAL AFFINITIES OF THE NEW ZEALAND PTERIDOPHYTE FLORA

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The problems of plant geography presented by the plants of the Southern Hemisphere are by their very nature more spectacular than those which exercise students of plant geography who are concerned solely with the distribution of plants in the Northern Hemisphere. In the Northern Hemisphere there is only one major barrier to plant migration, the Atlantic Ocean. The Bering Straits are relatively narrow and have certainly been dry in the relatively recent past. In the Southern Hemisphere, however, there are four major land masses — South America, Africa, Australia, and Antarctica, all separated from one another by substantial expanses of ocean. The islands of New Zealand, with which we are primarily concerned here, are similarly extremely isolated, there being some thousand miles of the Tasman Sea between New Zealand and Australia, the nearest continental land mass.

It is therefore not surprising that although the major problems connected with the origin and relationships of the British Flora — such as the presence of certain species of Mediterranean affinity, and some of North American affinity, in isolated localities along the western coasts of the British Isles — have been the subject of plausible explanations, the remarkable patterns of plant distribution in the Southern Hemisphere are still extraordinarily difficult to explain in an entirely satisfactory manner. It is intended to demonstrate in this article the peculiar interest of these problems of southern plant distribution, with particular reference to the pteridophytes of New Zealand.

We must first emphasise that, in relation to the pteridophytes, such problems of great difficulty really do in fact exist. It is sometimes somewhat facilely supposed that on account of their copious production of spores, which being of very light weight are wind-borne, pteridophytes must be more widely diffused and distributed than are flowering plants and that oceanic barriers, for instance, must be of little consequence. Study of actual plant distributions shows this generalisation to be manifestly unjustifiable. Thus it is known that not only do pteridophytes, and bryophytes and orchids as well, have distributions which by and large show the same characteristics of discontinuity, interruption, and apparent inconsistency as do flowering plants which possess relatively heavy disseminules, but moreover these former groups include a comparable proportion of endemic species. Long distance dispersal seems to be as ineffective an agent for explaining the presumed past migrations of pteridophytes as it is for flowering plants. It is true that such studies as those made on the recolonisation of the volcanic island of Krakatoa[8] clearly indicate that forty miles of sea is no obstacle to plant dispersal, but even to the pteridophytes a thousand miles of ocean appears to be in general an insuperable barrier.

It has been recognised for some time[4] that within the New Zealand flora elements with certain geographical affinities can be detected. It is

possible to classify the flora into palaeoendemic, cosmopolitan, palaeotropical, Australian, and Antarctic or South American elements. At the outset, it should be pointed out that these categories are not all mutually exclusive. For instance, the same species can be Australian and palaeotropical in affinity.

With relation to the vascular flora as a whole, the endemic element in the New Zealand flora is extremely large and by far the most important, including some 80% of the whole, an exceptionally high figure. The degree of endemism in the pteridophyta is much less though still very important, being of the order of 40%. Some outstanding and distinctive plants come into this category, including *Cardiomanes* (*Trichomanes*) *reniforme* (Forst.) Presl, *Leptopteris superba* (Col.) Presl, *Mecodium* (*Hymenophyllum*) *dilatatum* (Forst.) Copel., and *Loxsoma*, a monotypic and endemic genus. A significant fact is that the tree-fern genera, *Dicksonia* and *Cyathea*, with their huge spore production, nevertheless show a much higher degree of endemism than the New Zealand pteridophytes as a whole, some 75% of the New Zealand species of these two genera being endemic.

Recent researches have clearly shown that the cosmopolitan element in the New Zealand pteridophyte flora is much smaller than was previously considered to be the case. This fact was mentioned in an earlier article,[10] but the recent publication of cytological investigations by Brownlie,[2] makes it now possible to give fuller details. Thus *Hymenophyllum peltatum* (Poir) Desv. in New Zealand is found to have a chromosome number of $n = 11$, in comparison with $n = 18$ in Britain (Manton,[11] as *H. unilaterale* Bory). Equally striking is the case of the former *Hymenophyllum tunbrigense* of New Zealand, now cited as *H. revolutum* Colenso, which has $n = 22$, as against $n = 13$ for *H. tunbrigense* (L.) Sm. in Britain. In each of these two cases, the chromosome numbers found are without any numerical relationship to one another. Brownlie,[1] was also responsible for the discovery that *Asplenium trichomanes* L. in New Zealand is hexaploid, with $n = 108$, whereas only diploid and tetraploid forms are known elsewhere. However, in this case, the author's own investigations in New Zealand, still unpublished, show that although this endemic hexaploid is by far the commonest form of *A. trichomanes* in New Zealand, a tetraploid form is also present, which is apparently indistinguishable from the tetraploid form found in this country. Apart from this form of *A. trichomanes*, the only pteridophyte truly common to the British Isles and New Zealand is *Anogramma leptophylla* (L.) Link. *Cystopteris fragilis* (L.) Bernh. is tetraploid in New Zealand, with $n = 84$,[2] but in this case the plant is not identical with its British tetraploid equivalent, being morphologically quite distinct, its frond being less dissected, and the pinnules themselves larger and more rounded. The appropriate name for the New Zealand plant would seem to be *Cystopteris tasmanica* Hooker, since the New Zealand plant is identical with its Tasmanian and Victorian counterpart.

The element of palaeotropical affinity in the New Zealand pteridophyte flora is not inconsiderable. A number of predominantly tropical genera are

represented. These include such genera as *Cyclosorus*, *Nephrolepis*, *Sticherus*, *Dicranopteris*, *Lygodium*, *Pteris*, *Lindsaea*, *Adiantum*, and *Marattia*, and it is no accident that most of the New Zealand species of these genera are either restricted to the sub-tropical north of the North Island or are more abundant in this region than elsewhere in New Zealand.

The strongest affinity of the New Zealand pteridophyte flora is with the pteridophyte flora of the temperate regions of Australia. About 45% of the New Zealand pteridophytes are also present in eastern Australia.[9] From the Australian point of view the affinity is even more marked, for some two-thirds of the pteridophyte flora of Victoria and Tasmania are also found in New Zealand.[14] This common element in the Australian and New Zealand floras is far more significant amongst the pteridophytes than the flowering plants. Thus although 45% of the New Zealand pteridophytes occur in temperate Australia, this is true of rather less than 20% of New Zealand flowering plants. With regard to the Australian flora, the contrast is even more marked. Some 2,250 species of flowering plants are known to occur in Victoria and Tasmania, but only fewer than 250 of them occur in New Zealand, little more than 10%, in comparison with 60–70% of the pteridophytes.

This last point is well illustrated in the sub-tropical rain forest which is developed in suitable locations all the way down the coast of New South Wales from the Queensland border region. Although occurrences of this vegetation type become increasingly less frequent south of Newcastle, there are still isolated small pockets of this sub-tropical rain forest or "jungle" as far south as eastern Victoria. The general appearance of this forest type is much like the sub-tropical rain forest of New Zealand, but the trees and other flowering plants show little relationship with those of the New Zealand rain forest. However, there is a striking similarity between the fern flora of the New South Wales and Victorian rain forest and that of northern New Zealand forests.

Nearly all of the pteridophytes common to New Zealand and eastern Australia can be placed into one of two geographical groups. There are firstly such species as *Adiantum diaphanum* Bl., *Diplazium japonicum* (Thbg.) Bedd., *Pellaea falcata* (R.Br.) Fée, *Pteris comans* Forst., *Sticherus flabellatus* (R.Br.) H. St. John, and *Todea barbara* (L.) Moore, all of which are in New Zealand either almost or completely confined to the far north. In Australia, these species all extend south throughout New South Wales, and most also occur in Victoria, although generally much rarer in that state than further north. This first group of species are clearly of tropical origin, and indeed *Adiantum diaphanum* and *Diplazium japonicum* have wide ranges in the tropics today. The second group of species, which is the larger, is of mixed origin. These species are for the most part more or less completely distributed in New Zealand, while in Australia they are more abundant in Victoria and Tasmania than in New South Wales. Of some sixty species having this southern type of distribution in eastern Australia, more than fifty occur also in New Zealand.[14] Examples are *Blechnum fluviatile* (R.Br.) Lowe,

Ctenopteris heterophylla (Labill.) M. Tindale, *Hypolepis rugosula* (Lab.) J.Sm., *Asplenium flaccidum* Forst., *Mecodium rarum* (R.Br.) Copel., and *Phymatodes diversifolium* (Willd.) Copel.

It is also instructive to compare the pteridophyte flora of New Zealand with that of the far south-west of Australia. The south-west corner of Australia possesses an incomparable flowering plant flora, consisting of nearly 6,000 species within an area equivalent to that of the British Isles, This extraordinarily rich region is isolated from the rest of temperate Australia by a thousand miles of desert. Although the genera are nearly all the same as in eastern Australia, the vast majority of south-west Australian species of flowering plants are distinct from their eastern relatives. For example, although there are of the order of 400 species of *Acacia* in south-west and south-east Australia, if species of the arid desert margins are excluded, apparently only two species are common to both regions! In comparison with the flowering plants, the pteridophyte flora of south-west Australia is exceedingly poor, there being only twenty-four species. No less than sixteen of these also occur in New Zealand, although only an insignificant number of species of flowering plants is common to the two regions. The reason for this paradox is that the impoverished pteridophyte flora of south-west Australia is composed of species of general distribution over the favourable regions of Australia, and which thus also occur in eastern Australia.

We come now to the Antarctic or South American element in the New Zealand flora. There is, rather surprisingly, a small number of New Zealand ferns which are also found in the extreme south of South America. Nearly all of these also occur on one or more of the remote islands of the sub-antarctic oceans.

Sphaerocionium (*Hymenophyllum*) *ferrugineum* (Colla) Copel., a filmy fern found in the darkest parts of the New Zealand rain forest, is also found not only in Chile but also on the island of Juan Fernandez, 400 miles out into the Pacific off the coast of Chile.

Grammitis billardieri Willd. is a common fern in New Zealand, particularly in the South Island. Outside New Zealand, it not only occurs in eastern Australia, in southern Chile, and in the Falkland Islands, but also on the isolated island of Kerguelen. The nearest continental mass to Kerguelen Island, which lies almost on the 50th parallel of southern latitude, is Antarctica, some twelve hundred miles distant. Otherwise, Kerguelen lies nearly equidistant from South Africa and Western Australia. The flora of Kerguelen is of surpassing importance and interest for the southern hemisphere phytogeographer, and constitutes a topic to which we must return, but it is first necessary to mention two more species of fern which have distinctive circumantarctic distributions.

Blechnum penna-marina (Poir.) Kuhn is a common fern in New Zealand, though most abundant at montane levels in the Southern Alps. Outside New Zealand, it occurs in eastern Australia and southern Chile. It is also found on Tristan da Cunha and on Kerguelen, and also on the smaller Crozet

and Marion Islands, which lie between Kerguelen and South Africa, and on the Islands of St. Paul and Amsterdam, north of Kerguelen.

The distribution of *Polystichum mohrioides* (Bory) Presl is perhaps most curious of all. The only sizeable land mass where this fern occurs is southern Chile. It is also known from the Falkland Islands, South Georgia, from two small islands off the main coast of New Zealand, and from Marion Island (west of Kerguelen), and Amsterdam Island (north of Kerguelen), though not, apparently, from Kerguelen itself.

Having now briefly described the geographical affinities of the New Zealand pteridophyte flora, the problem remains how did these plants of various distribution all come to be present in New Zealand, separated as it is from its nearest neighbour of any substance, Australia, by a thousand miles of ocean.

We have already indicated that the long-distance dispersal of spores must be rejected as an effective means to explain the origin of the existing distributions of pteridophytes. There is no doubt that on account of their light spores pteridophytes can readily be dispersed from one ecologically suitable habitat to another some tens of miles distant, by-passing unsuitable terrain in between, but clearly the wind dispersal of spores must generally be an ineffective agent for securing the successful migration of pteridophytes across thousands of miles of ocean. There are exceptions to every rule, and it is quite possible that some orchids and pteridophytes have become established in New Zealand owing to the transport of their seeds and spores by the strong prevailing wind across the Tasman Sea from Australia. But even if long-distance dispersal of this kind has occasionally in such exceptional cases been successfully accomplished, we are still left without any explanation of the entirely comparable distributions found amongst the flowering plants, many of which have seeds or fruits which are so heavy that their natural long-distance dispersal is clearly impossible.

The earliest phytogeographical studies of any consequence in these southern regions are those of Sir J. D. Hooker, whose introductory essays to his Floras of Antarctica, New Zealand, and Tasmania, although written a century ago, are classical studies of this subject, and are still very well worth attention today for their scientific content as well as their historical interest. These, with others of Hooker's writings, have been admirably extracted and copiously annotated in relation to subsequent research by Turrill.[13] Hooker, who described the enigmas of southern plant distribution almost as we know them to day, came to the conclusion in relation to the New Zealand flora that the various migrations of floras which must have taken place in this region have most likely been effected through land communications across the ocean barriers, the intervening land having since disappeared.

Subsequent writers on the New Zealand flora, such as Cockayne,[4] have also felt compelled to rely on such hypothetical land bridges, even though some of these, on the basis of present continental distribution,

must have been very long, and even though in many cases studies of ocean levels seem to render it most unlikely that such a land connection ever existed.

In this connection the case of the island of Kerguelen, already mentioned, is instructive. The entire native vascular flora of Kerguelen is extremely small, there being only thirty species present, of which twenty-one are flowering plants and nine are pteridophytes. Although situated between South Africa and Australia, the flora of Kerguelen shows its greatest affinity with the flora of the tip of South America, the region known as Fuegia, seventeen of the thirty Kerguelen plants being found there also. Next in degree of affinity, and again in spite of the enormous separation in distance, is the New Zealand flora, for eleven of the flowering plants and probably four of the pteridophytes of Kerguelen are also found in New Zealand. The impoverished flora of Kerguelen cannot be accounted for by casual long-distance dispersal, for eight species are endemic*, including two which belong to endemic monotypic genera, and one of these, *Pringlea antiscorbutica* R.Br. ex Hook., has no known near relative. The existence of a land bridge from South America is clearly equally unlikely.

There remains the hypothesis of continental drift, the idea that the major continents were at one time far closer together and have subsequently drifted apart into their present positions. Ever since this hypothesis was first advanced in a comprehensive form by Wegener many biologists have pointed out its great potentialities as a means of explaining various problems of plant and animal distribution. However, notwithstanding the fact that Du Toit[7] produced a modified form of the hypothesis, removing the anomalies present in Wegener's original concept, continental drift remained subject to vigorous opposition, particularly from geophysicists who were unable to conceive of a mechanism by which the wholesale movement of continents might have been effected. In recent years the development of the study of rock magnetism has produced powerful evidence in support of the concept of continental drift. There is no space here to describe this new evidence, but the reader is referred to two admirable popular summaries which have recently appeared.[3,12] In consequence of this new development it can now be said that the total evidence, biological and geological, in favour of the hypothesis of drift has almost lifted the concept from a state of possibility to one of probability. What, then, is the significance of this hypothesis in relation to the problems being discussed here ?

According to Du Toit there were originally two great initial land masses, a northern mass named by him Laurasia and a southern mass known as Gondwanaland. It is this southern mass which concerns us further. Included in Gondwanaland were South America, Africa, India, Australasia and Antarctica. Significantly, most proponents of continental drift consider that the disruption of the masses took place relatively late in geological time, the major part of the movement taking place in the

* This is not strictly true, for all of these species occur on one or more of the other islands in the Kerguelen archipelago, namely Heard Island and the Crozet and Marion groups.

Tertiary period, in which the flowering plants were already the dominant vegetation type. It is further considered that the separation of South Africa and India took place before the splitting away of South America and Australasia from Antarctica. Kerguelen Island became detached directly from Antarctica. New Zealand and New Guinea became detached from the eastern coast of Australia and were subsequently displaced in position.

The separation of New Zealand must have occurred before the development of the characteristic Australian flowering plant flora as we know it today, for there are, for instance, no *Eucalyptus* or *Acacia* species native to New Zealand. What affinity does exist between the flowering plant floras of Australia and New Zealand is predominantly composed of species and genera of southern or Antarctic affinity and which are today in Australia mainly concentrated in the mountains of Victoria and in Tasmania. We have already seen that the affinity between the pteridophyte floras of Australia and New Zealand is very much stronger. It is not unreasonable to believe that the pteridophyte flora of Australasia at least in part developed earlier than the flowering plant flora and before New Zealand became finally dissociated from Australia. Equally, the general relationship found to exist between the pteridophyte floras of New Zealand, of both east and west temperate Australia, of southernmost America, and of Kerguelen Island is entirely consistent with the belief that the circumantarctic element in this flora had largely developed before the disruption of the great Gondwanaland continent had proceeded very far. There is therefore no need for the postulation of extended land bridges to explain the isolated and anomalous position of the Kerguelen flora which, instead, is seen to be entirely consistent with the presumed geophysical history of the region according to the concept of continental drift.

The apparent centring of the southern hemisphere pteridophyte floras, with the partial exception of Africa, upon Antarctica has intrigued many students of plant geography. The most extreme attitude is that of Copeland [5,6], who strongly supports the concept of an Antarctic origin for the majority of fern genera. His views have been strongly criticised by many but, if we were to substitute Gondwanaland for Antarctica, perhaps his hypothesis would come to be regarded as more acceptable.

P.S. This article was written before the Royal Society Discussion Meeting on "The Biology of the Southern Cold Temperate Zone" was held on December 10th and 11th, 1959. Several important papers relating to problems discussed in this article were read on this occasion and these will soon appear in print in the Proceedings of the Royal Society. J.D.L.

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CULTIVATION OF FERNS UNDER GLASS

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Ferns grown under glass can be discussed under two main headings, tropical and temperate. The tropical fern house needs to be maintained at 80°F. with high humidity from March till September; from October to February the temperature may be lowered to 65–70°F. The temperate fern house on the other hand, should be maintained at 50–60°F. throughout the year. They are not affected by the shorter days and growth may continue.

Light is the next most important factor. Tropical ferns are not used to such wide seasonal fluctuations as in our own climate, especially in day-length, but lowering the winter temperatures slows down growth and prevents them from becoming etiolated. Summer light is often too intense and the ferns must be shaded. This is best done by roller blinds, so as to allow the maximum amount of light in dull weather. The green shading " Summer Cloud " can be used; if it is a dull summer this makes the plants draw up vert weak and there is more risk of the plants getting fungal disease.

Propagation. The easiest and most interesting way to propagate ferns is by spores. The fertile fronds should firstly be inspected to make sure the spores are ready for collecting. With a lens or pocket microscope one can see if the sporangia have begun to open; when they are just beginning to open at the base of the frond that frond should be cut and placed in a large envelope and left in a dry room for two or three days, after which time the spores will have been shed and can be shaken out of the packet. Such spores may be stored in a *dry* packet for some months or may be sown immediately.

These can be sown in small pots or pans, the latter being far the best as the prothallus has more room to expand. A compost of two parts peat, one part loam and half part sand, sifted through a quarter-inch sieve, should be sterilised together with the pans and crocks. Whilst the pans can be immersed in boiling water to sterilise them, the soil cannot. A simple and efficient method is to place the soil in a thin sack and steam in a bucket over the gas: the soil should be prevented from touching the water by a brick or similar object and should remain at 180°F. for ten minutes. Only one piece of crock is necessary at the base of the pan and as the pans are to be stood in a saucer of water a thin layer of rough peat should cover the bottom. (Instead of water a weak solution of potassium permanganate may be used to keep down algae.) All water is taken up in this way and overhead watering is not necessary at any time. The pans are filled to within an half inch of the

top and a piece of glass cut to shape, or a clock-glass, if pots are used, is placed on the pan. (If a clock-glass is used it is important that the convex side is upper-most). These pans must be kept covered until the spores are sown.

The name of the fern should be written on a label before sowing. The glass is then taken off and the spores sprinkled on the surface of the soil; the label is placed in the pan and the glass cover replaced before sowing the next species to prevent contamination and the mixing of spores.

These pans are stood in saucers of water and put under the staging where it is moderately light but shaded from the sun. They can be left here until fertilisation has taken place and the young sporelings appear. From now on they need more light and must be stood on the staging but the cover glasses should remain over the pans for a few more days. The young sporelings are now large enough to handle and should be pricked out one dozen or so to a four inch pan and from then into small pots.

Propagation can be done vegetatively from bulbils (really buds) that arise on the back of the rachis. in, for example, *Asplenium bulbiferum*. If such a frond is taken off and pegged onto the surface of a pan filled with potting soil and placed in a closed frame the bulbils will quickly root. Other ferns form young plants at the axils of the pinna rachis, e.g., *Hemionitis palmata* and *Doryopteris pedata* and these can be propagated in a similar way. Rhizomatous species of *Polypodium* and *Davallia* can be started by cutting off a piece of rhizome with a growing point and planting this.

Composts. Peat is preferred to leaf soil when potting ferns because leaves carry eel-worm and this is not always destroyed when sterilising the soil. Tropical ferns grown much better in a light compost: one part fibrous loam, three parts granulated peat, half part sand. To each bushel of compost add 2 oz. super-phosphate, 2 oz. hoof and horn or bone meal, and 1 oz. potash. For the Maidenhair ferns (*Adiantum*) add some old mortar rubble. *Angiopteris* and *Acrostichum danaeifolium* being swamp species need a much heavier compost: one loam, one peat and half sand. A general compost for temperate ferns is one loam, two peat and half sand with the usual fertilisers, but for *Pteris* and *Osmunda* reduce the peat by half.

There is no need to put this soil through a sieve unless it is for small pots, just break the loam up with the fingers, and the peat which is purchased in a bale must be well soaked a week before use. Ferns should *not* be potted firmly; there is no need for a potting stick until the ferns are put into five-inch pots, and then only lightly to make sure the soil goes down between the plant and pot.

Ferns need watering at least once a day during the summer months and if it is very warm it is best to check that they are not too dry in the afternoon; water should be poured into the top of the pot until it is full; never half fill the pot and do not spray ferns overhead. The water should be allowed to drain onto the shingle or ash. Never have a pot standing in water. From October till February watering three times a week will be sufficient for most terrestial ferns but large tree-ferns (*Cyathea*) and *Osmunda* if in pots and not

recently potted are best watered every day. Species with rhizomes such as *Polypodium* and *Davallia* and epiphytes such as *Platycerium* need water only once a week in the winter months.

Pests. The chief pests are mealybugs and scale-insects although aphids can be troublesome. As most insecticides are harmful to ferns it is worth mentioning a few which have been found to be effective. " Diazitol " can be used against mealybug and aphids with very little damage being done at a strength half oz. to two gallons of water. "Malathion" or "Kill" can be used for scale-insects at the strength stated on the bottle but more care should be taken with this as it may cause damage to the very young fronds. Fumigating with " Nicotine Shreds " as stated on the packet, is good for aphids. A whole house of ferns can be ruined by the eel-worm, and prevention by keeping the foliage dry is the best answer. If a plant is attacked, the fronds should be cut off and the roots placed in a container of warm water (at 110°F.) for 10-15 minutes. Badly infected plants should be thrown out completely once spores have been taken for the propagation of the plant.

SHORTER NOTES

WOODSIA ALPINA (Bolton) Gray

Woodsia alpina is one of our rarest ferns. It does not grow below at least 2,000 ft. in Britain — it is better suited at 3,000 ft. — and the number of stations probably does not now exceed six on the mountains of Wales and Scotland. The appearance of the fern in a natural habitat is well shown in Dr. T. D. V. Swinscow's photograph reproduced in the 1955 issue of the Gazette (VIII, No. 5). It will be noticed that the fern has some overhead protection; and this is no doubt important because it gives shade and prevents damage by heavy mountain rains. The view that some such protection is needed is supported by the late Professor Bower's observation that alpine plants in Scotland are usually to be found on rocks facing N.E. There may, however, be further advantage in a covering of snow in the winter which at the top of some Scottish mountains, Ben Lawers, for instance, may persist until the late Spring; and the grimmer N.E. aspect may be helpful to high alpines, which are not well suited by our atlantic climate. It is well that this fern grows in places not accessible to the ordinary rambler — there was some reprehensible collection of it in the last century.

Woodsia ilvensis (L.) R.Br., almost equally rare, was at one time confused with *W. alpina.* It is slightly less exacting in its choice of habitats, both as regards altitude and shelter. It is rather larger, and the pinnae long as compared with the almost triangular pinnae of *W. alpina.* In course of time the two ferns came to be rightly regarded as distinct, and in recent years this view has been supported by a count of chromosome numbers: *W. alpina* has double the number of *W. ilvensis.*

The writer has himself never seen *W. alpina* in the wild in this country, but on a visit to Dauphiné in 1937, by a most extraordinary piece of good luck, came on the fern in the course of a stroll to fill in an hour or so when

detained *en route* at a mountain village. From this village at about 5,000 ft. was a track rising gently along an upper valley watered by a stream fed by a distant glacier. On a flattish area of this valley, at an altitude of probably rather less than 6,000 ft. were strewn large boulders which had obviously fallen at some time from crags high above. On one of the nearer boulders, more or less flat on the top, some vegetation was noticed which looked like Lousewort and proved to be so. On closer inspection it was seen that with the Lousewort were two or three ferns, and these were at once identified as *Woodsia alpina* — the peculiar indusium is unmistakable. There was no time to examine boulders further away and a little higher up, otherwise more plants of the Woodsia would probably have been found.

A year or two later some detailed information about Dauphiné plants was found in the Abbé Ravaud's " Guide du Botaniste dans le Dauphiné," published at Grenoble about 1890. The Abbé appears to have been a competent field botanist and he covers not only flowers but mosses and lichens, and ferns and fern allies. The book is schemed as thirteen excursions penetrating the mountains in different directions. *Woodsia alpina* is given as occurring in eight different places, but the habitat is described in one case only — the boulder-strewn valley described above. No mention is, however, made of *Pedicularis* (Lousewort) at this place. A rough estimate of the height at which *Woodsia* would be growing in the other places for which it was recorded is about 7,000 ft.

The proximity of the fern to the Lousewort was perhaps merely a coincidence, though the association may have been helpful to the fern. The species of the *Pedicularis* cannot be stated. The Abbé lists nine species for Dauphiné but not *P. sylvatica* L. The total number of species in the Central European mountains is approximately twenty. In this country we have two species only, *P. palustris* L. and *P. sylvatica* L.; and *P. sylvatica*, which grows among the British mountains, has often been mistaken for a fern; indeed, at a little distance it does bear some resemblance to *Woodsia alpina*. Edward Newman in his *History of British Ferns* quotes from Ray's *Synopsis* a comparison of the general appearance of *Woodsia* with that of *Pedicularis*.

Woodsia alpina falls within the category of artic-alpine plants. It is characteristic of such plants, suited by alpine conditions in central Europe, to tolerate lower altitudes in more northerly situations. *Woodsia alpina* is a straightforward example as growing at about 7,000 ft. in the Alps and 3,000 ft. in Britain. In northern Europe, e.g. Scandinavia, there is scope for it to descend nearer to sea level.

P. GREENFIELD

HERBARIUM SPECIMENS OF FERNS AND THEIR ABERRATIONS

Discussions in Ambleside and London at this year's annual meetings of the Society prompted the formation of a scheme for the preservation of herbarium specimens of ferns and their aberrations. Although the original concept was restricted to varieties (horticulturally desirable aberrants), it is felt that we should seek to embrace the subject completely in its relation to the botany

of ferns and fern-allies. This means that specimens should be preserved for the following main lines of approach:—

1) to illustrate the range of aberration, not only from separate localities but also within micro-populations; juvenile and secondary growth etc. should be included;

2) to build up a reference collection of authentic specimens of named varieties, bearing in mind the existence of a few herbaria such as those of Cranfield, T. Moore and Padley. Although the original type-specimens would be best for this purpose there are very few, or adequate pictures of them, in existence. Vegetative progeny from the original type would be the next best choice; it may of course be very difficult to be certain that what we have is undoubtedly clonal (uniform material derived from a single individual and propagated entirely by vegetative means). The selection and preservation of the most representative specimen from the authentic material available will, consequently, often be necessary. After these three methods of representation the most useful procedure is to collect together as many apparently significant specimens as possible;

3) to fill in vice-county distribution gaps for species in the *Preliminary Census List* on p.4.

The basic principles to be observed in making a dried specimen are three.

A) The simplest way is to place the fresh frond into a folder of unglazed paper (e.g., newspaper) in which it will be kept until finally mounted, immediately laying folder and specimen between several sheets of botanical drying-paper (or any porous paper — blotting-paper and the majority of newspapers are satisfactory) with a weight on top. To keep good colour and to minimise risk of moulding, change the drying-paper each day for the first few days. Gentle heat (e.g., beside a fire or on top of a hot-tank) may be used to hasten drying, in which case use the alternative method of applying pressure, viz., place the bundle between wooden lattices or similar stiffeners as in a botanical press, and tie tightly.

B) Uniformity of sheet size is desirable for herbarium curation. The *International Code of Nomenclature for Cultivated Plants, Utrecht*, 1958, recommends that specimens of nomenclatural importance be housed in a public herbarium. If, as seems generally acceptable, the British Museum (Natural History) is to be used, the sheet size would be 13 x 21 inches.

C) Adequate labelling is vital. For specimens other than varieties the basic details should be:— locality (with vice-county number and grid-reference, if possible), altitude, date, habitat, collector. For varieties in cultivation the following points should be covered:— full name of variety and name of original describer or finder; name and address of present owner; previous history of ownership; whether designated as being from the original (if so, whether clonal or from spore progeny); where grown (pot, greenhouse, garden, etc.); date of preservation; number (it is a good safe-guard against possible ambiguity if each plant and dried frond(s) therefrom bears a corresponding reference number); any other useful information.

J. A. CRABBE

THE ANNUAL EXCURSION 1959

The Excursion was held this year from the 5th to 13th September in conditions ideal for collecting. Blue skies and sunshine every day made the week an outstanding one in the annals of the Society, for very seldom indeed can our fern hunters have enjoyed such weather on the annual excursions. The ferns on the other hand were obviously not enjoying it, and were suffering badly from the drought, particularly those on walls, most of which were dried up. Everywhere we went, walls were draped with shrivelled fronds of *Polypodium vulgare* and *Asplenium trichomanes*, and in their more exposed habitats the Lady-fern and the Beech Fern also were looking in a sorry state.

Our party of 13 members and one visitor was the strongest we have mustered for very many years, although not all of them attended for the whole week. We were very pleased to welcome Professor R. E. Holttum to the Excursion, but our outings must have seemed very tame to him after his expeditions in Malaya, Indonesia and Borneo. The White Lion Hotel, Ambleside, was our headquarters, and made a very convenient centre for exploring in all directions without the necessity for going far afield. The terrain was a varied one, from cliffs, screes and ghylls on the mountains, to woodlands, road-sides, and the banks of streams in the valleys. Dried up streams and bogs allowed easy access to places difficult to approach in a normal season, and we were able to explore many interesting corners in consequence.

Two days were spent on the high hills rising from the Kirkstone Pass. There are old records for *Woodsia ilvensis* and *Asplenium septentrionale* from Red Screes, and the more active members of the party climbed this hill and concentrated their search on the cliffs and screes near the summit. Many ferns and flowering plants were seen, but the objects of our search eluded us. We did, however, find *Hymenophyllum wilsonii* in a deep ghyll on the mountainside, our only glimpse of this filmy fern during the week. Our other climbing expedition was in Deepdale on the north side of the Pass. A long walk up the dale led to an amphitheatre of precipitious hills at its head, where our party split into groups and worked up the slopes in different directions. Ferns were not plentiful here we found, and the finds of the day were not pteridophytes, but the alpine plant *Silene acaulis* and the creeping willow, *Salix herbacea*.

One more day was devoted to high ground — on Hutton Roof. This hill is 25 miles from Ambleside and outside the area we intended to cover, but as several members who had not been before expressed a wish to go there we were not averse to including it in the itinerary, for we all had a sneaking desire to revisit the limestone pavements with their fern-filled grikes. Nothing new was discovered but we all enjoyed the day.

The rest of the week was spent on low ground, one day at Ullswater and the others in the area lying on the west side of Lake Windermere. The Ullswater visit provided an enjoyable scramble up the bed of the Aira Beck where 14 fern species were noted. Among them were the Oak and Beech

Ferns, *Cystopteris fragilis*, *Polystichum aculeatum*, and many fine specimens of *Phyllitis scolopendrium* some of which were multifids; one good plant was collected. Later in the day at Glencoyne some crested Lady-ferns were found.

Ferns were plentiful around Skelwith Bridge and up Little Langdale. A rough road up Yewdale led us to Tilberthwaite Ghyll, where ferns were abundant in the slate screes and on the rock faces. During the short time we were there 16 species were recorded. *Asplenium trichomanes* grew to a very large size in the screes and there was a fine little colony of *A. viride* on a rock face rising from the beck. A few plants of *Polystichum aculeatum* were also noted. We had one of our best days here, and another, our last day, was enjoyed hunting in the country between Esthwaite Water and Newby Bridge. In Dale Park a scramble along the rocky bed of the stream led us through a fern paradise where the plants flourished with a tropical luxuriance. Beech Fern cascading down the slopes had exceptionally large fronds, and *Dryopteris borreri*, *Athyrium filix-femina*, and *Polystichum aculeatum* all grew to a large size. We finished our day — and the week — with the discovery of a fine Royal Fern.

In all we found 25 species of ferns.

Osmunda regalis L. — Ambleside, Dale Park Beck.

Hymenophyllum wilsonii Hook.— Red Screes.

Pteridium aquilinum (L.) Kuhn — in all areas.

Cryptogramma crispa (L.) R.Br. ex Hook.— Ambleside, Colwith, Deepdale, Glencoyne, Hawkshead, Red Screes, Tilberthwaite Ghyll.

Blechnum spicant (L.) Roth — Dale Park, Deepdale, Hawkshead, Red Screes, Skelwith Bridge, Tilberthwaite Ghyll.

Phyllitis scolopendrium (L.) Newm.— Aira Beck, Ambleside, Hutton Roof.

Asplenium adiantum-nigrum L.— Aira Beck, Tilberthwaite Ghyll.

A. ruta-muraria L. — Colwith, Dale Park, Deepdale, Glencoyne, Hutton Roof, Red Screes, Tilberthwaite Ghyll.

A. trichomanes L. — Aira Beck, Ambleside, Dale Park, Deepdale, Hawkshead, Skelwith Bridge, Tilberthwaite Ghyll.

A. viride Huds.— Hutton Roof, Red Screes, Tilberthwaite Ghyll.

Ceterach officinarum DC. — 1 mile S. of Skelwith Bridge.

Athyrium filix-femina (L.) Roth — in all areas.

Cystopteris fragilis (L.) Bernh.— Aira Beck, Hawkshead, Hutton Roof, Red Screes, Tilberthwaite Ghyll.

Dryopteris filix-mas (L.) Schott — in all areas.

D. borreri Newm.— in all areas, EXCEPT Deepdale and Red Screes.

D. abbreviata (DC.) Newm.— Colwith, Red Screes, Tilberthwaite Ghyll.

D. villarii (Bellardi) Woynar — Hutton Roof.

D. lanceolatocristata (Hoffm.) Alston — Dale Park, Hawkshead, Red Screes, Skelwith Bridge.

D. dilatata (Hoffm.) A. Gray — in all areas, EXCEPT Tilberthwaite Ghyll.

Polystichum aculeatum (L.) Roth — Aira Beck, Dale Park, Hutton Roof, Tilberthwaite Ghyll.

Thelypteris limbosperma (All.) H. P. Fuchs — Aira Bedk, Dale Park, Deepdale, Hawkshead, Red Screes, Skelwith Bridge, Tilberthwaite Ghyll.

T. phegopteris (L.) Slosson — Aira Beck, Ambleside, Dale Park, Deepdale, Hawkshead, Red Screes, Skelwith Bridge, Tilberthwaite Ghyll.

T. dryopteris (L.) Slosson — Aira Beck, Dale Park, Red Screes, Skelwith Bridge, Tilberthwaite Ghyll.

T. robertiana (Hoffm.) Slosson.— Hutton Roof.

Polypodium vulgare L. — Ambleside, Dale Park, Hawkshead, Hutton Roof, Skelwith Bridge, Tilberthwaite Ghyll.

The vice-county numbers and grid-references of the localities quoted are as follows: Aira Beck, v.c.70, 353/4020; Ambleside, v.c.69, 35/3704; Colwith, v.c.69, 35/3303; Dale Park Beck, v.c.69, 34/3592; Deepdale, v.c.69, 35/3913; Glencoyne, v.c.70, 35/3818; Hawkshead, v.c.69, 34/3598; Hutton Roof, v.c.69, 34/5578; Red Screes, v.c.69, 35/3909; Skelwith Bridge, v.c.69, 35/3403; Tilberthwaite Ghyll, v.c.69, 34/3000.

Once again varieties found were very few, and not of great interest. Within an hour of our arrival at Ambleside, many crested Lady-ferns were seen growing on walls and in the roadside ditches. Subsequent observation in the town confirmed the fact that this type of variation is very common, due no doubt to the spores that scatter far and wide from the many similar varieties growing in gardens. It was noted however that the variation never exceeded terminal crests and crested pinnae — the pinnules were always normal. A few similar finds were made at Ullswater and in Dale Park. Two crested Male Ferns were noted by the writer, but again in circumstances which indicated that they were garden escapes. A plant of *Dryopteris borreri* which could be described as a foliose *crispum* was collected, and in Dale Park some very large-growing Beech Ferns with crenate pinnules were found. On a wall at Ullswater a colony of *Asplenium ruta-muraria* contained many plants with large rotund pinnules, and some of these were collected. The multifid Hart's-tongues found at Aira complete a very meagre list of finds.

Evening discussions added to the interest of the Excursion which was very much enjoyed by all and came to an end all too soon.

J. W. DYCE

THE SECRETARY'S REPORT

The past year has seen many changes in the Society. We have welcomed our new President into office, but have had to accept with great regret the resignation of our Secretary and Editor, the Rev. E. A. Elliot, a step forced on him by ill-health. The award to him of the Stansfield Memorial Medal by the Society is an expression of our thanks for his invaluable services in the post-war years.

With this Gazette we introduce our new Editor, Mr. A. C. Jermy, who has been appointed to fill the vacancy at the British Museum (Natural History) created by the death of Mr. A. H. G. Alston. Mr. J. W. Dyce has been elected to the joint post of Secretary and Treasurer.

The Committee during the year discussed suggestions for developing the usefulness of the Society and plans for the future of the Gazette which is to be published annually in December. We are widening our scope to include not only British pteridophytes but world ferns and their allies, and our Aims have been amended accordingly. Our Constitution is in need of revision and a new one is being drawn up and will be submitted for approaval at the next A.G.M. after copies have been sent to all members.

More meetings are planned — indoor and outdoor. It is proposed to form two areas, one in the South and one in the North and day or weekend meetings can be arranged at convenient centres in both areas. Details will be advised to members in due course.

A fern exhibit at the Royal Horticultural Society's show on 11/12th August was proposed, but unfortunately had to be cancelled because sufficient ferns up to the required standard were unavailable due to the dry hot summer. Next year we hope to put up an exhibit on the date of the Alpine Garden Society's show in September. Full information will be sent out later but in the meantime will members willing to participate please give some thought to the selection of suitable plants and the attention necessary to achieve the desired high standard.

Another service to members, the correct naming of fronds sent to the Officers, requires the formation of a pressed collection of the varieties in existence today. This is discussed on another page and I hope all members in possession of good varieties will co-operate.

The Financial Statement for the year ended 30th June, 1959, is appended. It requires no comment — BUT, increased activities mean increased expenditure and we need more members. Prompt payment of subscriptions also helps, so will those members who have not yet found the time to put 10s. into an envelope and address it to me, please do so right away. Thank you.

FINANCIAL STATEMENT at 30th JUNE 1959

as presented and accepted at the A.G.M. on 26th September 1959

1958	£	s.	d.
30th June			
To Balance	53	2	7
Subscriptions	58	0	0
Donations	1	11	7
Sale of Gazettes	8	9	8
	£121	3	10
1959			
30th June			
To Balance	£87	3	5

	£	s.	d.
Gazette Vol. 8, No. 10	27	15	0
Subscription R.H.S.	2	2	0
Postages and Incidental Expenses:			
Secretary	1	0	0
Treasurer	3	3	5
Balance	87	3	5
	£121	3	10

(signed) J. W. DYCE, Hon. Treasurer

(signed) PETER TEMPLE, Hon. Auditor

NEWS OF MEMBERS

While at Ambleside, one of our party, Mr. T. A. Dyer, paid a visit to Morecambe and conveyed our greetings to Mr. Robert Whiteside and Mr. J. D. Dixon. Mr. Whiteside, aged 93, was one of the group of Lakeland fern hunters who founded our Society in 1891. He and Mr. Dixon, aged 83, still retain a keen interest in the Society and enjoyed a chat with Mr. Dyer on our activities. We wish them both well for many more years to come.

ADDITIONS TO MEMBERSHIP LIST

BLOOM, J., *Garden News*, 62, High Street, Stamford, Lincs.

BURNETT, L., 3, Beech Hill Road, Sutton Coldfield, Warwicks.

CARTWRIGHT, R. F., 143, Pitmansfield, Harlow, Essex.

FUCHS, H. P., PH.D., Pilgerstrasse 6, Basle, Switzerland.

JACKSON, J. F., Knotts View, Stonethwaite, Borrowdale, Keswick, Cumberland.

JERMY, A. C., B.SC., Department of Botany, British Museum (Natural History), Cromwell Road, London, S.W.7.

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THE

BRITISH FERN GAZETTE

NEW SERIES

VOL. 9 PART 1 DECEMBER, 1959

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THE BRITISH FERN GAZETTE

VOLUME NINE PART TWO

APRIL 1961

EDITED BY A. C. JERMY

THE BRITISH

PTERIDOLOGICAL SOCIETY

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The SOCIETY is open to all interested in any way in FERNS and FERN ALLIES upon paying an annual subscription of TEN SHILLINGS. Full details will be sent upon application to the SECRETARY.

THE
BRITISH FERN GAZETTE
NEW SERIES

VOL. 9 APRIL 1961 PART 2

Editorial

Over the past year the Society has expanded and brought into play new ideas in the way of more and varied meetings in the field. This issue of the *Gazette* puts forward yet another aspect, namely the inclusion of a paper on a non-British, yet European, genus of ferns — *Cheilanthes*; this has been included for several reasons but it should suffice to mention two very valid ones: first, it is a genus often grown in the greenhouse by British fern lovers and to those who grow these plants, although often North American species, it will not be new; second, and most important if we are to appreciate every aspect of ferns, we must look at genera other than those which are represented in our own restricted flora. There is in preparation at the moment a Flora of the vascular plants of Europe; Volume 1 of this *Flora Europaea* will contain 46 genera of ferns and fern-allies and its use to both professional and amateur botanist will be immense. The paper on *Cheilanthes* is therefore welcomed as a useful contribution towards the aims of this large project.

Fern Societies are not as numerous throughout the world as might be expected. I understand there is a recent one formed in Wellington, New Zealand and a well established Society in Japan whose President (Mr. Tomitaro Namekata, No. 481, Narita, Narita-Shi Chiba-Ken, Toyko, Japan) is very keen to exchange spores of any kind for growing.

In 1960 the American Fern Society published the 50th anniversary volume of the American Fern Journal. The quality and scope of this journal over the past 50 years can well be taken as a standard to be kept in the minds of Societies such as our own, an even older body in fact than the A.F.S. The papers are of interest to all our members and it is hoped to abstract several for the *Gazette* but this is a periodical that might well be taken with good effect by many of our provincial libraries. Indeed, the American Fern Society (Membership Secretary: Dr. W. S. Phillips, Department of Botany, University of Arizona, Tucson) would welcome members from this country and the $2.50 (eighteen shillings) annual subscription would be well spent.

The **BRITISH FERN GAZETTE** Vol. 9 Part 1 (pp. 1-32) was published 3rd March 1960.

THE FERNS OF THE CHANNEL ISLANDS

DAVID McCLINTOCK
Bracken Hill, Sevenoaks, Kent

Considering especially that they total only 75 square miles, i.e., less than two 10 km. squares, the Channel Islands have a particularly interesting variety of plants. Hundreds of thousands of visitors go there each year, but only very very few know what plants to look out for.

Check lists for each of the main groups of Channel Islands, Jersey, Guernsey, Alderney, Sark and Herm, are in hand, the first, for Herm, due to appear in 1961. Marquand's and Lester Garland's Floras ignored in effect any records not available in the Islands. Consequently any specimens in mainland herbaria want reporting as well as present localities. I hope therefore these notes on some of the ferns may result in fresh records. which are always welcome.

Lycopodium clavatum L. Stag's Horn Clubmoss was listed by Gosselin in 1788.

Selaginella kraussiana (Kunze) A. Braun. The only record for this Clubmoss is from Mr. P. J. Girard in July 1948 from under trees in a garden at Le Vallon, St. Martins, Guernsey. This is a plant which tends to be ignored for two reasons — that it is unobtrusive, and that people call it cultivated. But it can be a persistent weed of beds and turf, and the climate of the islands is right for it.

Isoetes hystrix Bory. This small and inconspicuous Quillwort has been well known in moist spots, mostly on L'Ancresse Common, in Guernsey since 1860. In 1957 we found it on several of the off-islets, often in good quantity. It is still to be seen in S.E. Alderney, but Marquand's more northerly locality " facing the coast of France " was rediscovered, by Mrs. F. le Sueur, only in 1960. Here is yet another plant which so far no-one has definitely found in the other islands. There is an undated specimen at Oxford labelled curtly " Jersey. H. E. Fox," but this is probably an example of the confusion often made between the various Channel Islands. It is usually at its best only up to about May, after which its fronds wither, before most visitors arrive. But I have seen them long and fresh and green in a wet August.

Equisetum sylvaticum. L. There are old unsupported records for Guernsey and Sark for this small graceful Horsetail.

E. telmateia Ehrh. This fine and equally graceful Horsetail has been long known in a restricted area north of the airport (although not originally so described!) in Alderney, and nowhere else in the archipelago, although there was a vague record of it about 1860 in Guernsey. In 1957, however, Mr. N. Jee showed it me in quantity as an exuberant weed in a friend's garden in St. Peter Port. The present owners know nothing about its origin but I have since learnt that it is occasionally offered by nurserymen.

Osmunda regalis L. Royal Fern is still to be seen wild in Jersey and Sark. In Herm it was planted in two places, one of them very prominent, between 1920 and 1923 during Sir Compton Mackenzie's reign.

Anogramma leptophylla (L.) Link. Many people — e.g., Mr. P. Taylor in his recent book — look on this small annual as only a Jersey fern, where it was found in 1852. But it was discovered in Guernsey, where there was a legend it was planted, as long ago as 1877. (Marquand calls it " Native?"). Admittedly it is rare there, and it seems that only a very few people ever knew where to see it. During the last war the late Mr. W. A. Warry was warned off by the Germans when he went to revisit it, and returned only in 1957 when he kindly led a party in search of it. The closest scrutiny of the very short stretch of road banks he indicated had failed, when one of us, Mrs. B. H. S. Russell, who had wandered 150 yards on, came on a fine colony, which is still there. It is not certain if this is Mr. Derrick's precise original locality. It might well be in Sark or other islands but dries up before most visitors arrive.

Adiantum capillus-veneris L. Maidenhair is clearly native in Jersey, although rare. It was recorded from Herm by Mr. G. Templeman in 1923 with no details and, so far as I know, no specimen. Close search has failed to refind it. In Guernsey its only place is on a tomb in the Cemetery, where it seems to have seeded itself: it does the same in old stonework elsewhere in the British Isles. There is an old and unsubstantiated record from Alderney.

Onoclea sensibilis L. There are records of the naturalised Sensitive Fern from Jersey by Mr. T. W. Attenborough from Plémont in August 1915, and by Mr. J. Piquet from Creux du Vis, St. Mary's.

Blechnum spicant (L.) Roth. Hard Fern is surprisingly scarce except in Jersey.

Asplenium obovatum Viv. Lanceolate Spleenwort is locally frequent, but it takes time to get one's eye in to know it from the more common *A. adiantum-nigrum*. I find the shorter stipe often tells more readily than the less triangular outline and the sori being nearer the margin help later as a check.

× *Asplenophyllitis jacksoni* Alston (*Asplenium adiantum-nigrum* L. × *Phyllitis scolopendrium* (L.) Newm). This rare hybrid was found by Mr. C. Jackson, in 1856, 57 and 58 at least, in Guernsey; and at Grève de Lecq in Jersey in November 1863 by " E.H.N." (who was this?). It looks like an untidy broad-pinnuled Black Spleenwort.

× *A. microdon* (T. Moore) Alston (*Asplenium obovatum* Viv. × *Phyllitis scolopendrium* (L.) Newm.) an even rarer hybrid, was found by Miss Wilkinson in 1855 in company with *A. obovatum* on a bank of rough masonry without mortar in St. Peter in the Wood, Guernsey; there is also a Guernsey specimen from " Mr. Griffiths " in June 1863. It has a similar untidy look to the last, and may also be being overlooked.

Ceterach officinarum DC. Except in Jersey the Rusty-back is also curiously rare by comparison with its abundance in the often otherwise similar S.W. England. One reason may be that walls are fewer.

Cystopteris fragilis (L.) Bernh. Mrs. le Sueur writes to me " There is something very odd about Bladder Fern in Jersey — the only island from which there are any reports of it. It has been recorded on several occasions yet there is only one specimen. It is inconceivable that Stanley Guiton whose principal botanical interest was ferns should not have taken a specimen of it when it was found in the Mourier Valley in 1919. In spite of extensive searches in recent years it has not been found there. Later Father Burdo recorded it but also failed to provide a specimen — yet he collected assiduously. The mystery grows deeper the further one delves. John Piquet in his notes on the Flora in the Bulletin of the Société Jersiaise for 1896 says " *Lastraea Oreopteris* Presl and *Cystopteris fragilis* Bernh. have been found here by the late Dr. Bull, and will have to be searched for." And now an undated unlocalised specimen of John Piquet's has just turned up, together with one labelled " July 1898, very rare, JP," but if he had this, why is it not mentioned in Lester-Garland's Flora?" This fern is said to have been planted out in Guernsey 80 years ago, presumably unsuccessfully.

Dryopteris borreri Newm. Observations on the comparative frequency of this segretate of Male Fern and of *D. filix-mas* (L.) Schott would be welcome. It has not yet been proved for Jersey.

D. aemula (Ait.) Kunze. This is a surprising apparent absentee in view of its plentifulness in the S.W. of Britain and frequency in the Weald, and in Normandy. There is a century-old unverified record for it from Guernsey.

Polystichum aculeatum (L.) Roth. The Hard Shield Fern has only two very old records, one each from Jersey and Guernsey, almost certainly erroneous, but it could presumably occur. *P. setiferum* (Forsk.) Woynar occurs but is rare.

Thelypteris limbosperma (All.) H. P. Fuchs (*T. Oreopteris* (Ehrh.) Slossons). The sole mention is by J. Piquet in 1896, see under *Cystopteris*.

Pilularia globulifera L. The only station for Pillwort was St. Peters Marsh, Jersey, whence it went when this was drained a century ago.

Azolla filiculoides Lam. There are now four records for this in Guernsey, all since 1952, but it is hardly wild yet and grows in no great quantity. So far, it is not known from the other islands.

Botrychium lunaria (L.) Sw. There are vague records for Guernsey, but only one specimen of this Moonwort, collected there a century ago.

Ophioglossum vulgatum L. ssp. *vulgatum*. Present records for the Common Adder's Tongue are two places in Guernsey, two in Jersey (close together) and one — among dense bluebells — on Brecqhou. Yet is is probably fairly widespread and overlooked — I know I easily overlook it!

O. vulgatum L. ssp. *ambiguum* (Coss. & Germ.) E. F. Warburg. This Adder's Tongue too could very well grow other than in Guernsey, where however, search in the S.W. of L'Ancresse Common has failed to turn it up since 1930.

O. lusitanicum L. Few people see this partly because of its very small size — 1 in.— and partly because it is over long before the holiday season. To see it at its best, go in December or January. It is still on the S. cliffs of Guernsey, where it was first detected in the British Isles in 1851 — the original letter is in the Brit.Mus.(N.H.). By an error it was recorded for Alderney in 1906. Yet the cliffs there, and in the other islands, seem not unsuitable. Both in Guernsey and St. Agnes, its only other British locality, its patches are near a large rock. There are specimens labelled " Jersey," by Sir Rawson W. Rawson, an experienced pteridologist, in 1862, but no details are known; and it is suspected that here is another example of the sort of geographical confusion made with the Quillwort and other records. Marquand however says several attempts were made to introduce it into Jersey.

In all 33 species have been known definitely from the Channel Islands, with five others unconfirmed.

I am most grateful to Frances le Sueur for many helpful comments.

IS IT A HYBRID OR A SPECIES?*

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There has been a good deal of confusion, especially in the *Dryopteris clintoniana-cristata-spinulosa* series, regarding the interpretation of a given specimen. Is it a hybrid or a species? The problem may be resolved with a few pieces of equipment and some diligent study.

In order to recognize the characteristic abnormal spores of hybrid ferns, it is necessary first to become acquainted with normal spores from sori of accurately identified specimens of the species involved. The sculptured spores are distinct for each species, and hence they may be compared with data already published.[1, 2]

It is wise to prepare permanent slides, using the medium Permount, and to keep a file for reference and for comparative study. An excellent space-saver for housing the slides is a metal box containing plastic drawers commonly used to store assorted oddments. The resolution of a simple compound microscope is sufficient for spore examination.

After the student has become familiar with the spores of several related species, he may undertake the study of their suspected hybrids. Spores produced by a hybrid fern can be quickly recognized, for a majority of them are tiny and aborted. Normally in any large sampling, however, there are also to be found some unusually large mis-shapen spores, presumably fertile. These abnormal spores exhibit a combination of the characters of both parents.

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It is sufficient for the beginner merely to separate the hybrids from the taxa meriting species rank on the basis of spore features. After one has mastered that phase of research, he may debate the parentage of these puzzling hybrids. Data to be considered specifically are gross morphologic details of the fronds and the microscopic characters of the indusia and abnormal spores.

Study of the specimens in several large herbaria shows that errors are often made in identifying *D. intermedia*, *D. spinulosa*, and their hybrid "var. *fructuosa*." In these collections, too, *D. clintoniana*, *D. cristata*, and their hybrid have been misinterpreted, yet the spores of each of these entities are distinctly characteristic. Curators of herbaria might well set aside unneeded extra sheets from *Dryopteris* collections for student work. Amateurs, too, will find this type of research interesting as well as useful in annotating their own specimens.

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THE GENUS *CHEILANTHES* SWARTZ AND ITS EUROPEAN SPECIES

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The genus *Cheilanthes* is represented in Europe by five different species, including the two taxa most European taxonomists consider to belong to the genus *Notholaena*. This latter discrepancy in generic interpretation together with the fact that the scientific names of two out of the five European species do not agree with the provisions of the Int. Code Bot. Nomencl. 1956 may justify the following discussions.

The boundaries between the two entities known under the names *Cheilanthes* Sw. (1806) Syn. Fil.:X,1,5,126 and *Notholaena* R.Br. (1810) Prodr.Fl.Novae-Holl.**1**:145 have always been rather artificial although the two genera are often considered to be distinct. FEE (1852) Gen.Fil.:155 therefore called *Cheilanthes* a "genus arduum," keeping the two genera *Cheilanthes* and *Notholaena* still separated. More than a century ago METTENIUS (1859) in Abh.Senckenb.natf.Ges.**3**:47–58 drew attention to the fact that *Notholaena* was an artificial genus and included in *Cheilanthes* most of the species formerly considered to belong to that genus. However, practically nobody followed METTENIUS in this view until DOMIN (1915) in Bibl.Bot.**20**(85):8 who pointed out that the form of the pseudoindusium is a rather uncertain distinctive character. This view became more and more general even though most subsequent pteridologists hesitated to follow

METTENIUS and DOMIN as e.g. C.A.WEATHERBY (1943) in Amer. Fern J.33:69 who in a short note on the typification of the genus *Cheilanthes* wrote about *Notholaena:* "(and nobody has ever known the boundary between the so-called genus and *Cheilanthes*) ", but treated, although in a posthumous publication, *Notholaena* still as a separate genus [cf.R.TRYON (1956) in Contr. Gray Herb.(179):1–106]. Also other modern authors, e.g. HORVAT (1927) in Act.Bot.Inst.Bot.Univ.Zagreb.2:92, did not agree with the view of METTENIUS and DOMIN. On the other hand COPELAND (1947) Genera Filicum: 65–66 included *Notholaena* within the genus *Cheilanthes* together with some other smaller genera kept separate by some taxonomists. This systematic question, however, can only be solved by a thorough study of all species pertinent to *Cheilanthes* and *Notholaena*, especially all the tropic species,[1] and has no or little relevance to the generic interpretation of the European species, as they all belong to the genus *Cheilanthes* in its strict sense.

The generic difference between *Cheilanthes* and *Notholaena* as generally accepted, lies in the organs which protect the young sorus. In the genus *Notholaena* the marginal sori are naked or at most covered by protrusions of the epidermis, whilst the sporangia of the species belonging to the genus *Cheilanthes* in its strict sense are covered by the reflexed margin of the pinnules. In this respect the two European species so far generally attributed to the genus *Notholaena* seem by no means to belong to this generic group, but are clearly representatives of the genus *Cheilanthes* in its strict sense. In *Cheilanthes marantae* (L.)Domin as well as in the species generally known under the binomial *Notholaena vellea* (W.T.Aiton)Desv.[non R.Br.] the marginal sori are covered by a very thin and narrow hymen originating from the edge of the pinnule. However, this feature can be seen only in a very young stage. In adult plants quite the contrary effect is observed, as the edges of the pinnule are bent outwards and upwards respectively. Therefore, the former upper surface of the pinnule is then on the inner side of the folded pinnule, the former underside being covered with the sporangia, which now form the outer side of the pinnule. This effect is most probably caused by a change of turgescence due to strong sunlight, as it is not present in plants growing in shady places.

The scientific name generally accepted for the genus under discussion is *Cheilanthes* which was first published by SWARTZ (1806) in his *Synopsis Filicum* on page 126 with the following description: " *Capsulae* in punctis discretis marginalibus, tectae (nec innatae); *Indusiis* e squamis membranaceis distinctis, *interius* dehiscentibus; l. e crenulis marginis ipsius replicatis." SWARTZ ascribed eighteen species to his new genus, however, two of them as " Inquirendae " but did not indicate a generic type. Thus, the typification of the genus was somewhat questionable, [cf. CHRISTENSEN (1906) Index Fil.:XLI and CHING (1941) in Hongkong Natur.10:194].

1 In this connection attention may be drawn to the fact that according to HARRIS (1955) in Bull. N.Z.Dep.Sci.Industr.Res.No.116:141–142 the spore morphology, at least of the only New Zealand species formerly put in the genus *Notholaena* R.Br., strongly suggests its inclusion in the genus *Cheilanthes* Sw.

JOHN SMITH (1875) Hist.Fil.:282 seems to be the first in designating a type: *Cheilanthes tenuifolia* (Burmann [1768] Fl.Ind.: 237, sub *Trichomane*) Sw. (1806) Syn.Fil.:129. His choice seems to be as reasonable as any other and, therefore, there was no need to choose another species as lectotype, as has been done by MAXON (1913) in Ill.Fl. NE. U.S. & Can.: 25 and (1925) Pter. Porto Rico: 428, who, however, just designated the first species mentioned by SWARTZ in the enumeration of the species, *Cheilanthes micropteris* Sw. (1806) l.c.:126, following the general attitude in typification of the U.S. botanists of those days. The fact that BRITTON and MAXON have been followed later on by WEATHERBY (1943) in Amer.Fern J.**33**:67–69 would be irrelevant according to the provisions of the Int.Code Bot.Nomencl. 1956:295, Appendix IV, para 4e, if PICHI-SERMOLLI in 1950 at the Seventh Int.Bot.Congr. in Stockholm [cf.PICHI-SERMOLLI (1952) in Int.Code Bot.Nomencl.:83; and (1953) in Webbia **9**:393] had not followed WEATHERBY, BRITTON and MAXON in typifying the genus *Cheilanthes* Sw. by *Cheilanthes micropteris* Sw. As the generic name *Cheilanthes* Sw. with the latter as type-species is included in the list of *nomina generica conservanda* [cf.PICHI-SERMOLLI (1954) in Taxon **3**:68] it seems that *Cheilanthes micropteris* Sw. has to be accepted as lectotype, there not being any taxonomic obstacle against this choice. However, this decision holds only as long as *Cheilanthes* Sw. is included in the list of *nomina generica conservanda*, and this seems not to be necessary as the following facts may explain.

Cheilanthes Sw. was proposed as a *nomen genericum conservandum* and included later on in the list accordingly because of the existence of the generic name *Allosorus* Bernh.(1806) in Schrader, N.J.Bot.**1**(2): 5,36 which was considered to be congeneric with *Cheilanthes* Sw. by several pteridologists. BERNHARDI described the new genus as having " *Sporangia* cathetogyrata, sessilia, subaggregata. *Hyposporangia* subcommunia, margine libero subpellucida " and further stated " Die Gattung *Allosorus* begreift vielleicht alle *Adianta spuria* Sw.: ausserdem *Adiantum pusillum* Willd.[2] (*Pteris acrosticha* Balb.), *Pteris crispa* und (wahrscheinlich) *heterophylla* Sw. Ich habe ihr den Namen wegen der verschiedenen Zusammenhäufung der Saamenbehälter gegeben. Bei manchen stehen sie grösstentheils einzeln (wie bei *Allosorus pusillus*), bei andern in Haufen. Bei manchen auf jedem Hyposporangium nur eines, bei andern mehrere." Thus, it becomes evident that the genus *Allosorus* Bernh. was at the time of its publication a " *mixtum compositum* " the morphologic character not being of generic value. This is also the reason why the generic name *Allosorus* Bernh. was used and typified by other authors in quite different ways.

The first in interpreting this generic name was SWARTZ (1806) Syn.Fil.: 425 who wrote in the " Index ": " *Allosorus* Bernh.— est *Cheilanthes*," and thus restricted *Allosorus* Bernh. to those species which are real *Cheilanthes*

2 The author's citation following the binomial *Adiantum pusillum* is rather puzzling. BERNHARDI ascribes the name to " Willd." whilst SWARTZ in the same year cites *Adiantum pusillum* with " Allioni " as the author. Even though apparently neither WILLDENOW nor ALLIONI ever published the binomial in discussion, it is more likely that the latter really used the binomial on herbarium labels.

in the original sense of SWARTZ. However, this choice of SWARTZ hardly agrees with the original concept of BERNHARDI, as the latter includes with some doubt the species of *Cheilanthes* Sw. in the "*Adianta spuria*" whilst *Adiantum pusillum* [Allioni, in hb.?, ex] Sw. and *Pteris crispa* (L.)All. are regarded as certainly belonging to the genus *Allosorus* by its author. Moreover the identification and restriction of the generic name *Allosorus* by SWARTZ was done only in the above-mentioned short note in the "Index" to his *Synopsis* and it seems quite probable that SWARTZ did not actually see BERNHARDI's publication, but cited BERNHARDI's new names only according to an oral or written communication which he most likely received from one of his two most important German correspondents, DANIEL MATTHIAS HEINRICH MOHR or FRIEDRICH WEBER.

The typification, and at the same time restriction, of the generic name *Allosorus* by *Osmunda crispa* L. as first proposed by ROEHLING (1813) Deutschl.Fl.,ed.2,**3**:31 corresponds much better to the original concept. Moreover, ROEHLING was the first to typify the genus *Allosorus* and there is no reason whatsoever for not accepting this typification and emendation. The most critical pteriodologists such as H.WOYNAR (1913) in Mitt. natw.Ver.Steiermk.**49**:147 and CHING (1940) in Sunyatsenia **5**:225 followed ROEHLING in typifying *Allosorus* Bernh. by *Allosorus crispus* (L.)Roehl. Thus, it seems to be irrelevant that in more recent times *Allosorus* Bernh. has been typified on quite different species by some American authors. UNDERWOOD (1899) in Mem.Torrey Bot.Club **6**:276 followed the manner of typification generally accepted by the older American taxonomists and chose *Pteris viridis* Forsk. (1775)Fl.aeg.-arab.:186, the first species listed by SWARTZ (1801) among his "*Adianta spuria*." That this choice hardly agrees with the original generic concept of *Allosorus* Bernh. has been mentioned before.

Much closer to BERNHARDI's concept of the genus comes the lectotype chosen by FARWELL (1931) in Amer.Midl.Nat.**12**:243, i.e. *Allosorus pusillus* ([All. ex] Sw.) Bernh. (1806) in Schrader N.J.Bot.**1**(2):36. This choice would probably match even better the original idea of the generic type of *Allosorus*, being the only combination made by BERNHARDI under *Allosorus*, and also the only illustrated species of the genus [cf.BERNHARDI (1806) l.c. t.2.f.6]. However, as mentioned before, there is no reason to disregard the first choice of the lectotype and that made by ROEHLING therefore has to be accepted. Thus, it seems that the generic name *Allosorus* Bernh. cannot stand as a synonym of *Cheilanthes* Sw. in the strict sense, and the latter therefore does not need to be conserved against the former.

KEY TO THE EUROPEAN SPECIES OF CHEILANTHES

Underside of pinnules, at least of adult plants, glabrous, or rarely with some scattered glanduliferous hairs; plants highly odoriferous (of cumarin)
2 ***fragrans***

Underside of pinnules ± densely covered with hairs or paleae:

Pinnules convex, with margins inrolled and thus ± covering the sporangia:

Upper surface of pinnules glabrous, lower surface with long hairs and no glandules; lamina oblong ... ... 4 *persica*

Upper surface of pinnules with occasional glandules along the midrib, lower surface with long hairs and glandules; lamina deltoid ... ... 5 ***hispanica***

Pinnules flat, or, especially in adult plants in very open habitats, folded upwards along the midrib, with margins only turned slightly downwards:

Upper surface of pinnules glabrous with scattered paleae along the midrib ... ... 1 *marantae*

Upper surface of pinnules lanuginous ... ... 3 *catanensis*

The first of the five known European species which was published with a binary name appears in the first edition of LINNAEUS' Species Plantarum as *Acrostichum Marantae* L. The transfer of this species to *Cheilanthes* Sw. was made only in 1915 by DOMIN in a footnote in his publication Beiträge zur Flora und Pflanzengeographie Australiens:

1. **Cheilanthes marantae** (L.)Domin (1915) in Bibl.Bot., Stuttgart **20**:133, adnot.1.

Acrostichum Marantae L. (1753) Spec.Plant., **2**:1071 (" *Maranta* ").

Polypodium Marantae (L.)Hoffm. (1796) Deutschl.Fl.Taschenb.**1795**(2):5, partim, quoad syn.Linnaei et forsan loc.Styriae sec. Haenke.

Polystichum Marantae (L.)Roth (1799) Tent.Fl.Germ.**3**(1):92 partim, quoad syn.Linnaei, C.Bauhini et Camerarii (" Polystichum? Marantae ").

Vittaria Ceterach var.*β*.Bernh. (1799) in Schrad.J.Bot.**1799**(1):315, excl.syn. Hoffmanni pro parte.

Acrostichum subcordatum Cav. (1801) in Anales cienc.nat., Madrid **4**:97.

Ceterach Marantae (L.)DC.apud Lam. & DC. (1805) Fl.franc., ed. 3. **2**:567.

Acrostichum canariensis Willd. in L. (1810) Spec. Plant., ed.4, **5**(1):121.

Cincinalis Marantae (L.)Desv. (1811) in Mag.natf.Frde., Berlin **5**:312.

Cincinalis subcordata (Cav.)Desv. (1811) in Mag.natf.Frde., Berlin **5**:312.

Notholaena Marantae (L.)Desv. (1813) in J.Bot.appl., Paris **1**:92.

Notholaena subcordata (Cav.)Desv. (1813) in J.Bot.appl., Paris **1**:92.

Notholaena canariensis (Willd.)Desv. (1827) in Ann.Soc.linn., Paris **4**:220.

Pteris canariensis (Willd.)K.B.Presl (1836) Tent.Pteridogr.:145.

Gymnogramme Marantae (L.)Mett. (1856) Fil.horti bot.Lips.:43.

GEOGRAPHICAL DISTRIBUTION. Mediterranean region (Albania, Yugoslavia [Serbia], Italy, Sicily, Corsica, France, Spain, Cyprus, Syria) north to Austria and Switzerland, westwards to the Atlantic islands (Canaries, Cape Verdes and Madeira) and eastwards to the Crimean Peninsula [Chatyrdagh] and the Caucasus region.

Whilst the nomenclature of the first mentioned species does not imply any difficulty, the binomial of the second, and also of two further European species, cause several nomenclatural problems. When LINNAEUS described the second European species as *Polypodium fragrans* L. (1771) Mant.Plant. **2**:307, he was not aware of the fact that he had used this binomial for a quite different taxon in 1753; the homonymous binomial published in 1771 was, therefore, illegitimate at the time of its publication. The fact that the two homonymous species later on were placed in two entirely different genera, the taxon from 1753 in *Dryopteris* Adans. as *D. fragrans* (L.)Schott and the taxon from 1771 in the genus *Cheilanthes* Sw., is irrelevant.

REICHARDT when editing the entirely new edition of the *Systema Plantarum* of LINNE was the first to realize the fact that LINNAEUS in 1753 and in 1771 chose the same name for two taxonomically different species and proposed therefore, entirely correctly, for the taxon described in 1771, a new name, *Polypodium pteridioides* Reich. Unfortunately, however, REICHARDT did not pay attention to the fact that the new proposed binomial was an illegitimate name because of the existence of the earlier homonym *Polypodium pterioides* Lam. (1778) Fl.franç.,ed.1,**1**:18.[4] One year after REICHARDT had published the new name for the taxon in discussion LINNE fil. transferred *Polypodium fragrans* L.(1771) to the genus *Adiantum* L. This first transfer, *Adiantum fragrans* L.fil. has to be considered as a *nomen novum* according to Art.72 of the International Code. In 1806 SWARTZ published *Cheilanthes fragrans* Sw., which was considered by practically all modern pteriodologists as being a different taxon from that published by LINNAEUS in 1771 as *Polypodium fragrans* L. This interpretation of SWARTZ' name, however, is only partly true. In fact SWARTZ was describing a quite different species from the East Indies which is known today as *Cheilanthes opposita* Kaulf., and excluded, though with some doubt, the taxon, called in modern publications *C. pteridioides* (Reich.) C.Chr. from the Island of Madeira. This latter taxon was confused with that from the East Indies for the first time by LINNE fil. when he published *Adiantum fragrans* L.fil. in 1781 and appears in SWARTZ' Synopsis as two separate species, namely *Cheilanthes odora* Sw. and *Cheilanthes suaveolens* Sw. All this, however, is irrelevant, as SWARTZ based his *Cheilanthes fragrans* Sw. definitely on *Polypodium fragrans* L. (1771) and therefore automatically on *Adiantum fragrans* L. fil. Thus, all these names bear the same nomenclatural type, and SWARTZ had no right to exclude the type of the taxon. Though description and locality ascribed by SWARTZ to his *Cheilanthes fragrans* match a different taxon, the name has to stand with the nomenclatural type, and thus SWARTZ' description and locality have to be excluded, and his combination must be accepted as the earliest legitimate name for the species in discussion:

4 The two specific epithets " pterioides " and " pteridioides " have to be considered as homonyms according to the examples (" *pteroides*, *pteroideus* ") cited in Art.75 on the Int.Code Bot.Nomencl. 1956 as " epithets treated as orthographic variants ". All four epithets are actually the same adjective, i.e., a Medieval form composed of the latin words *pteris*, *pteridis* = fern, and the latinized suffix -*ides*, originating from the Greek suffix εἰδής, -ές = similar, like.

2. **Cheilanthes fragrans** (L.fil.) Sw. (1806) Syn.Fil.: 127/325, excl.descr.et loc.

Adiantum fragrans L.fil. (1781) Suppl.Plant., Syst.Veg., ed.13:447; *nom.nov.*

Polypodium fragrans L. (1771) Mant.Plant.**2**:307; non L. (1753).

Polypodium pteridioides Reich. in L. (1780) Syst.plant., ed.noviss.**4**:424; non *P.pterioides* Lam. (1778).

Pteris acrosticha Balb. (1801) Elenco piante cresc.cont.Torino:98.

Pteris fragrans (L.fil.)Lagasca, Garcia & Clemente (1802) in Anal.Sci.nat., Madrid **5**:158.

Polypodium pteryoides Bory (1803) Essai Isles Fort., ant.Atlant.:311; *sphalm.*

Allosorus pusillus (All.)Bernh. (1806) in Schrad.N.J.Bot.**1**(2):36.

Cheilanthes suaveolens Sw. (1806) Syn.Fil.:127.

Cheilanthes odora Sw.(1806) Syn.Fil.:127/327.

Adiantum suaveolens (Sw.)Poir.apud Lam. (1810) Encycl.méth., Bot., Suppl. **1**:142.

Adiantum odoratum Poir.apud Lam. (1810) Encycl.méth.,Bot.,Suppl.**1**:142; *sphalm.*

Adiantum odorum (Sw.)DC.apud Lam. & DC. (1815) Fl.fran., ed. 3,**5**:237 ("Adianthum ").

Cheilanthes microphylla v.Buch. (1819) in Abh.Preuss.Akad.Wiss.**1816–17**: 360; *nom.nud.*; non Sw. (1806).

Adiantum pusillum [All.sec.Sw.] Poll. (1824) Fl.Veron.Prov.**3**:293.

Adiantum pumilum [Bell., in hb., ex] Colla (1836) Herb.pedem.**6**:195, in observ.

Cheilanthes maderensis [Lowe (1834), *nomen nudum*, ex] Lowe (1838) in Trans. Camb.phil.Soc.**6**:528.

Cheilanthes squamosa Heer & Regel (1851) in Linnaea **24**:174; non [Gillies, in litt., ex] Hook.et Grev. (1829).

Cheilanthes acrosticha (Balb.)Tod. (1866) Enum.Fl.sic.**1**:9; et in G.Sci.nat. Econ.Palermo **1**:215.

Cheilanthes Tinaei Tod. (1866) Enum.plant.sic.**1**:12; et in G.Sci.nat.Econ. Palermo **1**:217.

Cheilanthes hispanica sensu Nicotra (1891) in Malpighia **5**:435; non Mett. (1859).

Cheilanthes pteridioides (Reich. in L.) C.Chr. (1905) Index Fil.:178; non *C. pteroides* Sw. (1806).

Allosorus fragrans (L.fil.)Farw. (1931) in Amer.Midl.Natur.**12**:284.

GEOGRAPHICAL DISTRIBUTION. Mediterranean region (Crete, Greece, Albania, Italy reaching its northernmost point in the Vallée D'Aoste in the Alps, Sicily, Corsica, France, Spain, Portugal, Balearic Is., Morocco, Algeria, Tunisia, Libya) eastwards through Asia Minor to Daghestan and the opposite mountain range near Dzhebel in Turkmenistan and to Afghanistan, the Iranian mountains and W. Himalaya (Kashmir). Also on the Canaries and Madeira.

A third European species was described by W.T.AITON (1789) Hort. Kew., ed.1,**3**:457 under the binomial *Acrostichum velleum*. This species was attributed to the genus *Notholaena* R.Br. by DESVAUX (1813). This combination, however, was a later homonym of *Notholaena vellea* R.Br. (1810)

which is typified by an entirely different taxon. Also within the genus *Cheilanthes* Sw. the specific epithet " *vellea* " cannot be used, as there exists a transfer of R.BROWN's species to this genus by F.VON MUELLER (1866) Fragm.phytogr.Austral.**5**:123.

Ten years after W. T. AITON had described his *Acrostichum velleum*, DESFONTAINES published [July 1799] the same taxon again under the binomial *Acrostichum lanuginosum* Desf., assuming it to be a new species. POIRET (1816) in LAMARCK, Encycl.méth.,Bot.,Suppl.**4**: 110 transferred DESFONTAINES' species to the genus *Notholaena* R.Br., quoting as author of the new combination DESVAUX who, however, seems never to have published the combination *Notholaena lanuginosa* (Desf.)Desv. Whilst the specific epithet *lanuginosa* agrees with the provisions of the Code when the taxon is considered to belong to the genus *Notholaena* R.Br., it cannot be taken up under *Cheilanthes* Sw. as there exists a taxonomically different species *C. lanuginosa* Mart. & Gal. (1842) Mém.Acad.Brux.**15**:75/t.20.f.2.

The earliest valid specific name for the species in question under *Cheilanthes* Sw. seems to be *catanensis*, first published as a supposed new species as *Acrostichum catanense* Cosentini in 1827. Thus, the following new combination is needed:

3. **Cheilanthes catanensis** (Cos.)H.P.Fuchs **comb.nov.**

Acrostichum catanense Cos. (1827) in Atti Accad.gioenia, ser.i,**2**:207/218.

Acrostichum velleum W.T.Ait. (1789) Hort.Kew.**3**:457.

Acrostichum lanuginosum Desf. (1799) Fl.Atlant.**1**:400/t.256 [July 1799].

Cincinalis vellea (Ait.)Desv. (1811) in Mag.natf.Frde, Berlin **5**:312.

Notholaena vellea (Ait.)Desv. (1813) in J.Bot.appl., Paris **1**:92; non R.Br. (1810).

Notholaena lanuginosa (Desf. [" Desv.", sec.]Poir.apud Lam. (1816) Encycl. méth.,Bot.,Suppl.**4**:110.

Notholaena Plukenetii Fée (1852) Gen.Fil.:159.

Gymnogramme lanuginosa (Desf.)A.Br. (1854) Ind.sem.horti reg.Bot.Berol. **1854**:17.

Cosentinia catanensis (Cos.)Tod. (1866) Syn.Pl.Acotyl.Vasc.sic.:14; et in Giorn.sc.nat., econ., Palermo **1**(3/4):221, in observ.

Cosentinia vellea (Ait.)Tod. (1866) Syn.Pl.Acotyl.Vasc.sic.:14; et in Giorn. sc.nat., econ., Palermo **1**(3/4):220.

Gymnogramme vellea (Ait.)Kuhn (1868) Fil.Afr.:61.

GEOGRAPHICAL DISTRIBUTION. Mediterranean region (Crete, Greece, Italy as far north as Salerno, Sicily, Corsica, Spain, Portugal, Morocco, Algeria, Cyprus, Jordan, Palestine) expanding south to Ethiopia and east to Afghanistan. Also on the Canaries and Madeira.

The fourth species of *Cheilanthes* occurring in Europe is *C. persica* (Bory apud Bélanger)[Mett.in litt.ex] Kuhn and it is not at all clear when the basionym, *Notholaena persica* Bory apud Bélanger, was published. In accordance with FOMIN apud KOMAROV 1934, Fl.SSSR **1**:76 all modern Russian floras cite 1833 as the date of publication of the second part of BELANGER's *Voyage aux Indes-Orientales* without any remarks, whilst FIORI 1943, Fl.ital.crypt.**5**:272, also adopting this date of publication for *Notholaena persica* states in a note that the date of publication of BELANGER's work is not at all certain. PAMPANINI 1906, in Nuovo G.bot.ital.N.S.**13**:139-157 used the binomial *Cheilanthes Szovitsii*[5] Fisch.v. Waldh. & C.A. Meyer apud Hohen. throughout his paper and discussed at length the date of publication of BELANGER's undated publication. KUHN, in Bot.Ztg.**26**:233 adopted 1833 and in Fil.afr.:73, 1831 (in error?), RUPRECHT 1845, Beitr.Pfzenkde.Russ.Reiches **3**:48 cited 1833 as the date of publication, however with doubt, whilst MILDE 1867, Fil.eur.atlant.:33, as well as NYMAN 1883, Consp.Fl.eur., Suppl.**1**:861 cited as the date of publication of *Notholaena persica* Bory apud Bélanger the year 1838, and C. B. CLARKE 1880, in Trans.Linn.Soc., Lond., ser.2,Bot.**1**:455 pointed out, that the binomial *Notholaena persica* was published four years after the publication of *Cheilanthes Szovitsii*, i.e. in 1842. PRITZEL 1872, Thes.lit. bot., ed.2:20, and SHERBORN & WOODWARD 1901, in Ann.Mag. nat.Hist., ser.7,7(40):390, and 1901, in J.Bot.,Lond.**39**:205 accordingly accepted as the date of publication for the cryptogamic part of BELANGER'S *Voyage* the year 1846, the latter authors pointing out, that according to a note in the *Bibliographie de France* in 1834 parts 2 and 3 of the work in discussion were published, but contained only plates and wrappers. Recently, a note appeared in the Fl.Males.Bull.**15**:730–731 [August 1960] pointed out, that according to a review by BRANDES 1835, in Lit.Ztg.**1835**(4):69 [January 21, 1835] two printing sheets (i.e. pp.[1]–32) and eight plates were already published before this date.[6] Therefore, it is evident, that the binomial *Notholaena persica* Bory appearing in the second, and only published volume of BELANGER'S *Voyage aux Indes-Orientales* on page 23 has priority over the name *Cheilanthes Szovitsii* Fisch. v. Wald. & C. A. Meyer which indeed appeared as early as in December 1833 in a paper by HOHENACKER, entitled "*Enumeratio plantarum in territorio Elisbethopolensi et in provincia Karabach sponte nascentium*," however only as a *nomen nudum*, but was validly published with a Latin description only in June or July 1838 in another paper by HOHENACKER, "*Enumeratio plantarum, quas in itinere per provinciam Talysch collegit Fr. R.Hohenacker*":

5 Dedicated to JOHANN JOSEF SZOVITS (x –1831), pharmacologist in Odessa, who collected plants in Hungary, Galicia, Southern Russia as well as between 1828 and 1830 in Northern Persia and the Caucasus, where in the region of Karabakh, he first found the species named after him.

6 That the date of publication of BELANGER's work as accepted by RUPRECHT as well as by modern Russian floras and FIORI is correct, has been proved recently by Mr. R. Ross [British Museum (Natural History)] who very kindly communicated the results of his researches which will be published shortly [cf. ROSS 1961, in J.Soc.Bibl.nat.Hist. **4**:(in press)].

4. **Cheilanthes persica** (Bory apud Bélanger) [Mett., in litt., ex] Kuhn (1868) in Bot.Ztg.**26**:233 [April 3, 1868]; Fil.Afr.:73.

Notholaena persica Bory apud Bélanger (1833) Voy.Indes. Orient., bot.**2**:23 "*Nothochlaena*" [before March 25th, 1833].

Cheilanthes Szovitsii [Fisch.v.Wald. & C.A.Meyer apud Hohen. (1833) in Bull.Soc. Nat. Moscou **1833**(6):260, *nomen nudum*,, ex]Fisch.v.Wald.et C.A.Meyer apud Hohen. (1838) in Bull Soc Nat.Moscou **1838**(3):241, cum descr.

Cheilanthes fimbriata Vis. (1842) Fl.Dalm.**1**:42/t.1.f.1.

Acrostichum microphyllum A.Bertoloni apud G.Bertoloni (1856) Propag. agric.**6**:343.

Oeosporangium fimbriatum (Vis.) Vis. (1867) in Atti Ist.veneto, ser.3,**12**:656.

Oeosporangium Szovitsii ([Fisch.v.Wald. & C.A.Meyer apud Hohen., *nomen nudum*, ex]Fisch.v.Wald. & C.A.Meyer apud Hohen.) Vis. (1867) in Atti Ist.veneto, ser.5,**12**:656/t.10–11.

Oeosporangium persicum (Bory apud Bélanger) Vis. (1872) in Atti Ist.veneto, ser.3,**16**:44.

Notholaena Szovitsii ([Fisch.v.Wald. & C.A.Meyer apud Hohen., *nomen nudum*, ex]Fisch.v.Wald. & C.A.Meyer apud Hohen.)Keyserling (1873) Polypod.et Cyath.Herb.Bungeani:28.

Myriopteris Szovitsii ([Fisch.v.Wald. & C.A.Meyer apud Hohen., *nomen nudum*, ex]Fisch.v.Wald. & C.A.Meyer apud Hohen.)J.Sm. (1875) Hist. Fil.:281.

GEOGRAPHICAL DISTRIBUTION. Mediterranean region (Italy[Ravenna], Yugoslavia [Dalmatia, Montenegro, Hercegovina], Aegean Is.) southwards to Algeria eastwards through Turkey, Crimea, Iraq, Transcaucasia and Persia to Central Asia (Turkmenistan, Tien-shan, Pamir-Alai) and to the Himalayas (Kashmir and Punjab).

5. **Cheilanthes hispanica** Mett. (1859) Abh. senckenb. natf.Ges.**3**:74.

Cheilanthes fragrans var. *hispanica* (Mett.) Fiori (1943) in Fl.ital.crypt. **5**:270, in adnot [February 20th, 1943].

GEOGRAPHICAL DISTRIBUTION. Ranging from the south-western part of the Iberian peninsula [Portugal and S.W. Spain (Estremadura Mts.)] to Spanish Morocco and Tunisia.

SUMMARY

The generic value of *Notholaena* R.Br. is somewhat questionable and it seems that probably all species of this genus should be included in the genus *Cheilanthes* Sw. As to the two European species so far included in the genus *Notholaena* R.Br. the general taxonomic problem is irrelevant as both are true *Cheilanthes* in the strict sense. It is argued that the latter generic name does not need to be conserved against *Allosorus* Bernh., the latter by reason of typification not being congeneric with *Cheilanthes* Sw. Two out of the five European species bear generally used names which do not agree with the provisions of the International Code of Botanical Nomenclature. The following changes

in nomenclature are therefore necessary: the species generally known as *Cheilanthes pteridioides* (Reich. in L.) C.Chr. has to be called *Cheilanthes fragrans* (L. fil.)Sw.; the species generally called *Notholaena vellea* (W.T.Ait.) Desv.,non R.Br. needs a new combined name, *Cheilanthes catanensis* (Cos.) H.P.Fuchs. General distribution of, and a key to, the five species is included.

THE SOUTHPORT SPRING FLOWER SHOW, 1960

Mr. Tom Bolton adjudicated Classes 8-20 (the fern classes) as in previous years. The following is a list of the prize-winners submitted by Mr. Bolton and, where it has been possible to obtain the information, names of the plants exhibited; the comments in quotation marks are those of Mr. Bolton.

CLASS 8 A group of hardy British ferns.

1st prize and the Challenge Cup: Mr. John Brookfield — " the plants were very clean and well grown. I noted one plant of *Victoriae* that was outstanding."

CLASS 9 Six hardy ferns.

1st: Mr. J. Brookfield — " . . . group included a very good plant of *Clarissima.*"
2nd: Mr. B. Hayhurst.
3rd: Mr. J. Pye.

CLASS 10 Three Scolopendriums.

1st: Mr. B. Hayhurst — *S. vulgare* (*Phyllitis scolopendrium*) *crispum, S.v. crispum Drummondii, S.v. ramomarginatum.*
2nd: Mr. J. Pye.

CLASS 11 Three Polypodiums.

1st: Mr. J. Brookfield — " these were in large pots and an outstanding exhibit."
2nd: Mr. B. Hayhurst — *Polypodium vulgare cambricum, P.v. cristatum Forestii, P.v. congestum.*

CLASS 12 Three Polystichums.

1st: Mr. B. Hayhurst — *Polystichum setiferum divisilobum densum, P.s.d. cristatum, P.s. gracile.*
2nd: Mr. J. Brookfield.
3rd: Mr. J. Pye.

CLASS 13 Three Athyriums.

1st: Mr. J. Brookfield.
2nd: Mr. N. H. Almond.
3rd: Mr. J. Pye — *Scolopendrium vulgare crispum, S.v. crispum Drummondii, Athyrium f.-f. Victoriae, A. plumosum Druery, Polystichum setiferum pulcherrimum Bevis, P.s. diversilobum densum.*

CLASS 14 Three Lastreas.

1st: Mr. J. Brookfield.
2nd: Mr. B. Hayhurst — *Lastrea* (*Dryopteris*) *pseudomas ramossima, L.p. cristata angustate, L.* (*Dryopteris*) *filix-mas grandiceps.*
3rd: Mr. N. H. Almond.

CLASS 15 Three Asleniums.

1st: Not given. " This was rather a poor class for exhibits."
2nd: Mr. J. Brookfield.

CLASS 16 Three hardy British ferns.
1st: Mr. J. Brookfield.
2nd: Mr. N. Robinson — *Cryptogramma crispa, Dryopteris aemula, Polystichum setiferum.*
3rd: Mr. B. Hayhurst — *Adiantum capillus-veneris, Ceterach officinale, Phyllitis scolopendrium* (*Scolopendrium vulgare*).

CLASS 17 One hardy British fern.
1st: Mr. B. Hayhurst — *Polystichum setiferum diversilobum plumosum.*
2nd: Mr. J. Pye.
3rd: Mrs. M. L. Bassnett — *Scolopendrium vulgare crispum Campbellii.*

CLASS 18 Six greenhouse ferns.
1st: Mr. J. Brookfield.
2nd: Mr. J. R. Eaves.
3rd: Mr. B. Hayhurst — *Adiantum* " Kensington Gem," *Onychium japonicum, Davallia canariensis, Pellaea rotundifolia, Nephrolepis exaltata, Nephrolepis exaltata elegantissima.*

CLASS 19 Three greenhouse ferns.
1st: Mr. J. Brookfield.
2nd: Mr. J. R. Eaves.

CLASS 20 One greenhouse fern.
1st: Mr. J. Brookfield.
2nd: Not given.
3rd: Mr. B. Hayhurst — *Adiantum* " Kensington Gem."

SHORTER NOTES

THE REDISCOVERY OF ASPLENIUM × MURBECKII Dörfl.

When botanising some years ago on Castle Crag in Borrowdale I noticed a very small stunted fern with fronds about an half an inch long growing on a ledge of the iron-hard volcanic rock almost out of my reach. However, I managed to get a couple of fronds and saw immediately that it was an *Asplenium*. Well grown specimens of *A. trichomanes*, *A. septentrionale* and *A. ruta-muraria* were in the vicinity and on first examination I took the fronds to be those of *A.* × *alternifolium* Wulf. (*A. septentrionale* × *A. trichomanes*). Later in the season I again visited the locality, this time with my son, who after a short rock-climb secured a good plant. I was now able to have a good look at the plant and I noticed that the apex of the pinnules was very finely toothed and not rounded as in *alternifolium* and I began to have doubts as to its precise identity. However, I eventually planted it on a ledge in the fernery where it stayed for some time but it never increased in stature. Recently I decided to pot up the plant in porous volcanic scree and leaf-mould, both of which we have plenty at hand, and in this the fern grew strongly and soon began to show its true character.

It was then that I consulted my never-failing source of information the octavo edition of Thomas Moore's *Nature Printed British Ferns* and found that *A. ruta-muraria* var. *cuneatum* T. Moore (now *A.* × *murbeckii* Dörfl.) fitted my plant very well both in description and in figure. I sent a specimen to Mr. Jermy who agreed that it could well be *murbeckii* and he sent some material on to Dr. D. A. Meyer (at the Botanic Garden and Museum,

Berlin-Dahlem) who has worked on *Asplenium* hybrids for some years and he confirmed the identification. Part of my original plant is now in cultivation at Chelsea Physic Garden.

FRED JACKSON

TRANSPLANTING FERNS

Ferns are very accommodating plants and can be transplanted successfully at any time of the year, even during the hottest weather. Major alterations to my fern borders this year compelled me to move, during our warmest and driest spell of weather early in the summer, a very large growing plant of *Dryopteris borreri* with fronds almost four feet long. I did not hesitate to divide the several crowns although the root system suffered in the process. Given my usual treatment and well watered in, the fern settled down happily with no wilting of the fronds, and new ones were soon being thrown up. This habit of ferns is invaluable to the fern-hunter, who can confidently excavate a treasured find from the hedgerow at any season of the year and establish it successfully in the garden.

Most growers will probably lift ferns carefully with as much root as possible and replant them with a minimum of disturbance, and some of my fern friends have looked rather doubtful when I have explained or demonstrated my method of dealing with ferns when transplanting or introducing them from the wild. As it has proved very successful with me, it may be of interest to others.

First, the plant is placed in a bucket of water and all the soil washed away from the roots so that I can see what I am doing. Buried among the roots of a large plant, particularly if it is an old one, will usually be found a length of dead stem which is broken off, and then beginning from the bottom all the old frond bases right up to the living fronds are pulled off. With big strong growing ferns I find a pair of large pliers very helpful for this task. Care should be taken to remove as few roots as possible; these grow from the bases of the fronds and the loss of some is unavoidable but has no adverse effect.

It is remarkable how small a large fern rootstock becomes after this treatment, but replanted carefully and well watered in, it is soon growing vigorously again. With the removal of all the old stumps the new roots from the bases of the living fronds are able to move easily and quickly into the surrounding soil and the growth of the plant benefits accordingly.

J. W. DYCE

POLYSTICHUM ACULEATUM PULCHERRIMUM BEVIS

This beautiful fern was found in 1876 and for over 30 years was reputed to be barren, until a few spores were found on plants in the possession of Mr. C. T. Druery and Dr. F. W. Stansfield. Sowings produced some most remarkable results, including *Polystichum aculeatum pulcherrimum Drueryi*, *P. aculeatum plumosum Greenii*, and the *P. aculeatum gracillimums*. The first

two are strong-growing outdoor ferns, but the *gracillimums* are, to quote C. T. Druery, " of wonderful delicacy of cutting, the parental half-inch pinnules being extended sometimes to nearly three inches, and of almost hairlike tenuity, with splayed tassel-like terminals."

No further recorded finds of spores on " Bevis " have been made since before the first World War, although there is no doubt that plants *have* borne spores since then. I have grown the fern since 1952, and each year have examined my plants hopefully but in vain. However, this summer when working in my fern garden, I lifted a frond of " Bevis," and to my utter amazement found myself looking at undoubted sori. On two adjacent pinnules on a pinna near the apex of the frond, I counted eight in all. Unfortunately the discovery was made rather late, for most of the sporangia had dispersed. A large number still remained however, and the pinna was carefully broken off and placed in a folded paper. A few days later the spores were shed and were immediately sown in a prepared pan.

At the time of writing I have a prolific crop of prothalli from which I hope to obtain many good ferns, and possibly something entirely new.

J. W. DYCE

HERBARIUM SPECIMENS OF FERNS AND THEIR ABERRATIONS. II

Following the policy outlined in the last number of the *Gazette* (pp. 26-27), Mr. T. A. Dyer has made a collection of pressed fronds from ferns growing in his garden at Alrewas. He pursued this self-imposed task with great enthusiasm and has made an excellent job of preservation and labelling and has provided a plan of his garden with specimen locations marked with their numbers; 96 specimens were handed over at the 1960 Annual General Meeting with a promise of more to come. Five specimens were sent by Mr. R. Kaye in November.

It is hoped that this building up of the Society's herbarium will continue with the sending of named and well-labelled specimens, especially fronds from prize-winning plants.

J. A. CRABBE

BOOK NOTES

" BRITISH FERNS AND MOSSES "

By P. G. TAYLOR pp. 1–231 illustr.

" The Kew Series " (Eyre and Spottiswode, 1960) Price 25s.

" British Ferns and Mosses " is the fourth volume of " The Kew Series " to appear and it maintains the high standard of production as others in this series of which R. D. Meikle's " British Trees and Shrubs " is perhaps most well-known. Perhaps it should be said at the outset that it was the publishers' unfortunate decision to include the mosses and this presented the author

with the uneviable task of choosing one-twelfth of our British species. It is a pity that Mr. Taylor did not choose species closely associated with fern habitats and at the same time include the more conspicuous liverworts. This section [pp. 177–217] as presented, without keys and in systematic order, can be of little help to the beginner; but it is for what Mr. Taylor has written on ferns and their allies that this book will be considered.

As in the previous volumes there is an Introduction [pp. 9–12] which acquaints the reader with the botanical terms used and with the life-histories of the fern (and moss) plant. Since there is a Glossary [pp. 220–226] it seems a pity to have confused the text throughout with definitions which often lack uniformity and become ambiguous [e.g. p. 15, " Sori . . . are of several distinct shapes . . . kidney-shaped or *reniform* (as in *Dryopteris* . .), oval or linear (as in *Asplenium* . .) . . ."]; the use of *italics* is confusing [why " modified *fertile* fronds " p. 15 l. 16?]. And is " Hybridisation in the vascular cryptogams . . . of rare occurrence " ? In all our larger genera (eg. *Dryopteris*, *Asplenium*, *Polystichum*) hybrids are formed frequently between species living in the same habitats. Apogamy and apospory are not discussed.

The greater part of this book (pp. 23–176) is devoted to the description of the majority of our species of ferns and related groups, together with data on habitat preferences useful to all who grow ferns. There is a *single* key to all species mentioned; it might have been more workable to have separate keys for the major natural groups. In that excellent part of the key dealing with *Equisetum* Mr. Taylor makes it apparent that he has studied the genus in some detail; on the whole it is a practical key but I think the inclusion of geographical distribution at any stage in a key is dangerous because if a reader sees that his specimen is outside the range given he will rarely check its morphology (this could arise over *Ophioglossum lusitanicum* and *O. vulgatum* ssp. *ambiguum*). It would have been worthwhile to include in the key the odd species of flowering plant that could be confused with *Isoetes* (eg. *Littorella uniflora*) — in the latter species the leaf section (easily seen with a hand lens) is made up of several tubes; in *Isoetes* there are four tubes only.

It is true to say that, for the most part, the taxonomy of our British species of *Pteridophyta* is well known but I find it disappointing that Mr. Taylor has virtually ignored the fundamental work done during the last 15 years by Professor Manton and her colleagues at Leeds University. It is true that the Introduction would have had to include a short discourse on chromosomes and the importance of meiosis but so much more could then have been discussed. On p. 166, under *Polypodium*, " a form " is described which is in fact the diploid (*P. australe* Fée) and Taylor says " results of the [recent] investigation suggest that it should perhaps be treated as a distinct variety or even a distinct species, though there seems to be some doubt as to its correct name." Here is an example that clearly shows how cytological evidence *has* helped the taxonomist and there is an interesting story to be told if only Mr. Taylor could have mentioned *chromosomes* and *meiosis*.

Again in the genus *Dryopteris*, the work of Walker in the *dilatata-spinulosa* complex has been forgotten and in the *D. filix-mas* complex *D. abbreviata* (DC.) Newm. is omitted; Lovis' work on the synthesis of *Asplenium* × *alternifolium* (*Breynii*) has, I am glad to say, been briefly mentioned [p. 118].

As the author says in the introduction he has based his classification (and presumably his nomenclature) on Warburg in Clapham, Tutin and Warburg, 1952, but he deviates, I am pleased to see, in upholding *Gymnocarpium* [p. 161] with two species, *G. dryopteris* (L.) Newm. and *G. robertianum* (Hoffm.) Newm. both of which were placed in *Thelypteris* in Warburg. There is a minor slip on p. 133 where Linneus is given as the authority for *D. filix-mas* instead of (L.) Schott.

The book is beautifully illustrated in both line and colour by Miss Ann Webster. Many of our species could be identified from these alone but there are two places where I feel the artist has been misdirected. A good character, mentioned by Taylor and used to distinguish between *Equisetum arvense* and *E. palustre* is the length of the lowest internode of the branch in relation to the length of the main stem nodal sheath; this could have been made clear in the magnified inset drawing on Plate 2 [*E. arvense*] and similarly in Fig. 9 [*E. palustre*] if the total length of the lowest internode had been figured. In Plate 6 the magnified " base of pinna " labelled *D. borreri* does not show at all well the truncate apex to the pinnule; in fact the magnified drawing of the single pinnule of *D. filix-mas* is more typical of *borreri*. The absence of a scale in all the drawings is something for which Miss Webster cannot be forgiven; *Lycopodium annotinum* [Fig. 2B] is surely bigger than *Selaginella selaginoides* [Fig. 3].

One can appreciate Mr. Taylor's difficulty in putting over a modern concept of fern taxonomy to the non-specialist and there are occasions (e.g. in the descriptions of variants within a complex) where he himself is perhaps unsure. In such circumstances he has been wise to approach the subject as he had and what he has done is commendable. In spite of its seemingly high price, it is a book worth owning.

A. C. JERMY

FARNE IM HERZEN EUROPAS

By GEORG EBERLE pp. I–VIII, 1–116, illustr. 1959

Obtainable from W. Kramer and Co., Frankfurt am Main, Germany
Price DM 8,50.

This book on Central European ferns is published as one of a series of Natural History Handbooks by the Seckenberg Natural History Society. The first part of the book contains sections on the structure and life-history of the ferns in general and this is followed by a section on hybridity, taking into account the cytological work of Professor Manton and D. E. Meyer. The descriptive pages (21–40) show that the author is an observant field botanist and the 88 first-class photographs of these ferns in their natural

habitats strengthen this view. Forty-four of our own native species are illustrated in 67 photographs and this alone makes this book a useful possession of the British fern-lover.

It should be noted that in a recent review Dr. D. E. Meyer pointed out that the lower photograph on p. 102 is not *Polystichum* × *illyricum* as labelled but is *P. lonchitis*. The shape of the frond and the inflexed lower pinnae of the *Polypodium* on p. 109 suggests that this is the hexaploid species.

A. C. JERMY

"THE FERNS AND FERN-ALLIES OF BRITISH COLUMBIA"

By T. M. C. TAYLOR pp. 1–154, illustr. 1956.

Obtainable from the Provincial Museum of Natural History
and Anthropology, Victoria, B.C., Canada.
Price 75 cents (incl. postage).

This is No. 12 in the series of Handbooks published by the British Columbia Provincial Museum Department of Education. It is a neatly produced pocket-size book which covers a region not too dissimilar in climate and flora from our own and about 40 of our species are described and figured (by clear line drawings) together with ecological notes. One of the assets of this book to the British pteridologist is that it gives him a wider concept of our smaller genera.

A. C. JERMY

THE BRITISH PTERIDOLOGICAL SOCIETY

THE ANNUAL EXCURSION 1960

The 1960 Annual Excursion was held in North Somerset from the 3rd to 11th September with headquarters at the Egremont Hotel, Williton. Ten members attended during the week, Dr. J. Davidson, Messrs. J. A. Crabbe, P. Greenfield, N. Robinson, W. Wright and the Secretary arriving on the Saturday, and we were joined on the Wednesday by Mr. and Mrs. T. A. Dyer and Mr. L. Burnett, and on the Friday by Mr. P. Temple. Fine weather favoured us and on only one day, Tuesday, did it rain. It so happened we planned to spend this day visiting some habitats of bog ferns, and they were seen under conditions very much to their liking, if not to ours.

Two previous excursions in recent years have been held in this area comprising the Brendon and Quantock Hills, but not much ground can be covered in a week, and after this third visit there still remain many good places awaiting our future attention. As usual in the West Country, the hunting was chiefly among *Polystichum setiferum*, with the hope ever constant in our minds and undimmed by past failure, that we would come upon a good variety of this fern which has produced so many of the finest known varieties.

There seems to be some magnetic attraction for us in a certain deep valley in the Brendon Hills. We commenced our last Excursion to the area in 1957 with a visit to this spot which in 1956 had given us some good hunting. Again this year the decision to start here was unanimous. Nothing new was found, but some of the party were exploring the West Country for the first time, and it was pleasing to introduce them to this wild fern garden which has so much to show. We have recorded 14 species from this valley, some of them but not *Polystichum setiferum*, growing in great abundance. *Dryopteris aemula* is found here, a beautiful fern which never fails to arouse admiration in the beholder, and contributes greatly to the attraction of the place.

During our previous excursions to North Somerset, most attention has been given to the Brendon Hills area, but this year we concentrated more on the Quantocks. A network of lanes run up and along the west side of these hills, most of them unexplored by us, and we decided it was time to remedy this omission. They are rich in ferns but in very few did we find more than nine or ten species. *P. setiferum* was common everywhere and provided interesting hunting. In one lane near Crowcombe the only plants of *P. aculeatum* seen during the week were found. There were only a few, but it was observed that most of the *P. setiferum* in the lane seemed to exhibit some *P. aculeatum* characters. Several of the plants were of vigorous growth with very wide crispate and foliose tripinnate fronds, and some good specimens were collected. It was near this lane that the find of the week was made by Mr. Greenfield — an incised form of *Asplenium trichomanes*.

The one wet day was spent very appropriately further afield in the flat country beyond Bridgwater, in search of bog and water ferns. This low lying district is drained by a network of rhynes or ditches, in some of which the water fern *Azolla filiculoides* is to be found. One good colony was discovered, and near it, the green dust covering the surface of the water was found to be an extensive colony of the rare *Wolffia arrhiza*, the smallest known flowering plant. Near Shapwick, *Thelypteris palustris* is literally a weed infesting the moor, but we noted that in the open it was not so prolific as on our previous visit, and it was suggested that the exceptionally dry summer last year may have dried up the moor sufficiently to kill it. In the woodland nearby this fern grows rampantly with fronds three feet high, along with *Dryopteris lanceolatocristata* (*spinulosa*) and *Osmunda regalis*. Floundering in a boggy wood, and forcing a way through the undergrowth in a downpour of rain, could not be regarded as pleasant even by the most enthusiastic hunter of Royal Ferns however, and after finding two magnificent plants we felt we had achieved sufficient to excuse a quick retreat.

Two more days were spent outside our immediate hunting grounds — on the northern edge of Exmoor. This was new territory which we wanted to learn something about for future visits; we followed up a record for *Hymenophyllum tunbrigense* which led us into a fine wooded combe south of Porlock and what we saw of the lanes between Dunster and Porlock

augered well for an excursion in this district. We did not find the *Hymenophyllum* but had an enjoyable day's hunting with a bag of 14 species which included a large flourishing colony of *D. aemula.*

During the week we recorded 20 fern species.

Osmunda regalis L. — Shapwick Heath.

Pteridium aquilinum (L.) Kuhn — common everywhere.

Blechnum spicant (L.) Roth — Druid's Combe, Hawkcombe, Kingsbridge, Nettlecombe, Riscombe Exford.

Phyllitis scolopendrium (L.) Newm. — Crowcombe, Hawkcombe, Holford, Huish Barton, Huntscott, Kingsbridge, Monksilver, Nettlecombe, Riscombe Exford, Stogumber Station, Westwood.

Asplenium adiantum-nigrum L. — Crowcombe, Hawkcombe, Holford, Huish Barton, Huntscott, Kingsbridge, Monksilver, Stogumber Station, Westwood.

A. trichomanes L. — Crowcombe, Hawkcombe, Holford, Huntscott, Kingsbridge, Monksilver, Riscombe Exford, Stogumber Station.

A. ruta-muraria L. — Crowcombe, Hawkcombe, Holford, Huntscott, Kingsbridge, Stogumber Station,

Ceterach officinarum DC. — Crowcombe, Holford, Shapwick.

Athyrium filix-femina (L.) Roth — Crowcombe, Druid's Combe, Hawkcombe, Holford, Huntscott. Kingsbridge, Monksilver, Nettlecombe, Riscombe Exford.

Dryopteris filix-mas (L.) Schott — Crowcombe, Druid's Combe, Hawkcombe, Holford, Huish Barton, Huntscott, Kingsbridge, Monksilver, Nettlecombe, Riscombe Exford, Stogumber Station, Westwood.

D. borreri Newm. — Crowcombe, Druid's Combe, Hawkcombe, Holford, Huntscott, Monksilver, Nettlecombe, Riscombe Exford, Stogumber Station.

D. lanceolatocristata (Hoffm.) Alston — Shapwick Heath.

D. dilatata (Hoffm.)A.Gray — Crowcombe, Druid's Combe, Hawkcombe, Holford, Kingsbridge, Monksilver, Nettlecombe, Riscombe Exford.

D. aemula (Ait.) Kuntze — Druid's Combe, Hawkcombe.

Polystichum setiferum (Forsk.) Woynar — Crowcombe, Druid's Combe, Hawkcombe, Holford, Huish Barton, Huntscott, Kingsbridge, Monksilver, Nettlecombe, Stogumber Station, Westwood.

P. aculeatum (L.) Roth — Crowcombe.

Thelypteris limbosperma (All.) H.P.Fuchs — Druid's Combe, Hawkcombe, Riscombe Exford.

T. palustris Schott — Shapwick Heath.

Polypodium vulgare L. — Crowcombe, Druid's Combe, Hawkcombe, Holford, Huish Barton, Huntscott, Kingsbridge, Monksilver, Nettlecombe, Riscombe Exford, Stogumber Station, Westwood.

Azolla filiculoides Lam. — Burrough Bridge.

The vice-county numbers and grid-references of the localities quoted are as follows; Burrow Bridge v.c. 5, 31/3530; Crowcombe v.c. 5, 31/1436; Druid's Combe v.c. 5, 31/0037; Hawkcombe v.c. 5, 21/8745; Holford v.c. 5, 31/1541; Huish Barton v.c. 5, 31/0538; Huntscott v.c. 5, 21/9243; Kingsbridge v.c. 5, 21/9837; Monksilver v.c. 5, 31/0737; Nettlecombe v.c. 5, 31/0537; Riscombe Exford v.c. 5, 21/8339; Shapwick v.c. 5, 31/4137; Shapwick Heath v.c. 5, 31/4137; Stogumber Station v.c. 5, 31/1137; Westwood v.c. 5, 31/1534.

Very few varieties were collected, but this year we can record one first-rate find — *Asplenium trichomanes* "*incisum*" found in the Crowcombe area by Mr. Greenfield, growing on a roadside wall in a large colony of normal forms of the fern. Some very fine incised forms of *A. trichomanes* have been found in the past, but as far as is known are no longer in existence, and Mr. Greenfield's find is probably superior to any *incisum* in cultivation today. It is intended to put a frond into the Society's Herbarium. Other finds included a colony of *A. trichomanes* with terminal forking of which several were collected by the party, and some plants of crispate and foliose *P. setiferum.*

J. W. DYCE

REPORTS OF MEETINGS 1960

THURSLEY AREA, SURREY, SUNDAY MAY 22ND. Eight members attended this meeting which met at Godalming B.R. Station at 10 a.m.; from there transport was by means of private cars. We made our way S.W. on the A3 road and explored first some wet woods close to the Thursley road turning. Several ferns were in abundance and of particular note were *Dryopteris lanceolatocristata*, *D. dilatata* and, by all appearances, the hybrid between the two. The first-mentioned species was definitely less developed, whereas the *dilatata* exhibited full crowns of open fronds. We continued to Thursley Bog to search for *Lycopodium inundatum*, *L. clavatum* and *L. selago*, all of which were recorded for Thursley by C. E. Salmon early this century. Only *L. inundatum* was found however, and this was frequent in the wetter hollows which had escaped burning earlier in the year. The afternoon was spent at Waggoner's Wells, just over the Hampshire border, and here a number of *Dryopteris* were observed in an attractive setting of *Montia sibirica* in full bloom. Throughout the day a number of stone-brick bridges were investigated with the hopes of finding *Ceterach officinale*, but in vain.

TUNBRIDGE WELLS, SUNDAY JUNE 26TH. Five members attended this outing to the wooded district south of Tunbridge Wells. At Eridge Green we recorded ten fern species, including *Hymenophyllum tunbrigense* on the sandstone rocks. The common fern was *Dryopteris dilatata*, and a fine colony of *D. borreri* was found. The other species were *Polypodium vulgare* growing on the rocks, *Dryopteris filix-mas*, *Athyrium filix-femina*, *Pteridium aquilinum* and a few plants of *Thelypteris limbosperma*, *Asplenium adiantum-nigrum* and *Blechnum spicant*. We hoped to find *Dryopteris aemula* at Saxonbury Hill but were unlucky. The six species found here were *P. aquilinum*, *A. filix-femina*, *D. dilatata*, *D. lanceolatocristata*, *B. spicant* and *T. limbosperma*.

We finished the day at Mayfield in search of *Polystichum aculeatum* but again were unlucky.

BRENTWOOD, ESSEX, SATURDAY OCTOBER 1ST. This outing was held jointly with the London Natural History Society in Thorndon Park Woods. It rained most of the time but our party of ten, which included six of our members, had an enjoyable day. Ferns were found only in small areas and we recorded only seven species. *Athyrium filix-femina* was abundant and the other common species were *Dryopteris filix-mas*, *D. borreri* and *D. dilatata*. One colony of *D. lanceolatocristata* was found and a visit was paid to Essex's only recorded colony of *Polystichum setiferum* which consists of about three plants.

NORTHERN MEETINGS. Two meetings were held in the North, the first at Bakewell on August 13/14th, but only one member turned up to support the Meetings Secretary. The second held in Borrowdale on October 8/9th was

more successful and the five members participating agreed that in spite of wet weather it was well worth while. A total of 22 species was found, and included *Osmunda regalis*, *Hymenophyllum wilsonii*, and the rare *Asplenium septentrionale*. Quite a few plants of the spleenwort were seen, and the filmy fern covered the rocks in great sheets.

EXHIBITS AT THE A.G.M. Some well-grown potted ferns were shown by the President, including *Thelypteris limbosperma*, *T. phegopteris* and *Polypodium vulgare* collected durning the Excursion to Ambleside in 1959.

Mr. Greenfield exhibited his *Asplenium trichomanes* "*incisum*" found during the 1960 Excursion to Somerset and the Secretary also showed fronds from the same fern, as well as the pinna from his plant of *Polystichum aculeatum pulcherrimum* Bevis showing the rare phenomenon of sori on this fern.

Mr. J. F. Jackson from Borrowdale had two very interesting exhibits, fronds from an *Asplenium septentrionale* hybrid with *A. ruta-muraria* (*A.* × *murbeckii* Dorfl.) and a narrow form of *Dryopteris dilatata*.

J.W.D.

OBITUARIES

EDWARD ARTHUR ELLIOT

The death of the Rev. E. A. Elliot on the 19th February, 1960, was briefly announced in a notice sent with the last issue of the *British Fern Gazette*.

Mr. Elliot had been Editor of the *Gazette* since 1949 and Secretary of the Society since 1950, holding both Offices until 1959, when failing health forced him to resign. He had in fact needed medical treatment intermittently for some considerable time, but made light of it and carried on his various duties with great determination. He was able to continue local walks for botanical purposes and recorded a large number of plants for the Mapping Scheme of the Botanical Society of the British Isles.

Mr. Elliot was born in 1890 at Kingsbridge in South Devon. His ancestors had been connected with that part of Devon for several hundred years, and he himself owned property near the village of South Milton until a few years ago. He was educated at Sherborne School and Christ Church, Oxford. He was ordained in 1915 and appointed to a curacy at Portsea (Portsmouth), one of several large parishes in poor districts in England considered to be beneficially tough training grounds for the Clergy. For a time in the 1914-1918 War he served in a non-combatant capacity with the British Army in France and Belgium. After a temporary break-down in health he left Portsea in 1921. Subsequently, in 1924, he became Vicar of Dunstall, near Burton-on-Trent, doubtless glad to resume life in rural surroundings; and it was in Staffordshire that he married. While at Dunstall

he joined the British Pteridological Society, and developed a keen interest in ferns. The fruit of some painstaking work on scales under the microscope was printed in Volume VI of the *Gazette*, and he was from that time in constant touch with the Editor, Dr. F. W. Stansfield at Reading. He left Dunstall in 1929 and took charge for three years of the parish of Longstone on the eastern fringe of the Derbyshire Dales. In 1932 he became Rector of Cubley — some ten miles west of Derby, and remained there until 1936. During this period he was made President of the North Staffordshire Field Club, with which he had been associated for some years. His final move was to South Stoke, near the southern end of the Chiltern Hills. Among other advantages was the proximity of Oxford. He frequently visited the City and seldom missed an opportunity of going into the Botanic Garden. Reading was equally accessible, and he was able to pay occasional visits to Dr. Stansfield, thus extending his knowledge of fern varieties and learning a good deal about the back history of the British Pteridological Society. This experience stood him in good stead on his appointment as Secretary in 1950 at a time when the Society had only partially succeeded in reviving itself after the suspension of its functions during the War.

Mr. Elliot might almost be said to have a passion for making friends, more particularly among people interested in botany and gardening. He maintained good relations with our members at home and abroad and was especially gratified to receive personal visits from members of the American Fern Society.

In recognition of his work for the Society over a long period of years, carried on until illness enforced his resignation, he was awarded the Stansfield Memorial Medal at the Annual General Meeting on the 26th September, 1959 — the fourth award since the medal was instituted in 1938. This tribute gave him great satisfaction.

Mr. Elliot was buried at South Milton, where mural tablets to the memory of several of his forebears can be seen in the village church.

P. GREENFIELD

J. Dargue Dixon

It was with great regret that members who had met Mr. Dixon in the North of England heard that he had died, at the age of 83, on the 22nd of February, 1960.

Mr. Dixon was elected a member of the Society at the Annual General Meeting held at Southport on the 27th August, 1931. At the time he was living at Rochell Park, Dumfries. It was not until for business reasons he moved to Hest Bank on Morecambe Bay that he became well known to several of our members as a skilful and enthusiastic cultivator of ferns. He was elected to the Committee of the Society in 1936.

A fernery Mr. Dixon built inside a large greenhouse with sandstone brought from Scotland was a source of admiration to those who saw it both for the pleasant effect of the rock, and the splendid development of the

ferns. Some of us invited to his house at Hest Bank and hospitably received there, saw ferns growing on a terraced bank, the species in this case being those for which shade was not essential. In later years, after the loss of his wife, Mr. Dixon was fortunately able to live with a married daughter at Morecambe where he was not far away from our veteran member Mr. R. Whiteside. The writer has pleasant recollections of joining these two friends on more than one occasion for a talk on old times. After the Meeting at Ambleside in 1959, Mr. T. Dyer on behalf of members present conveyed their greetings to Mr. Dixon and Mr. Whiteside, an attention which they much appreciated.

P. GREENFIELD

THE SECRETARY'S AND TREASURER'S REPORT

We can look back with some satisfaction on a year of progress, marred only by one sad event — the death of the Rev. E. A. Elliot; tribute to him is paid elsewhere in this issue. We have widened our scope to deal with world ferns and their allies, but the British ferns still continue to be our major interest, catered for not only by our Annual Excursions but by day meetings and weekend meetings held in different parts of the country. The large majority of our British members should now be able to attend at least one meeting annually without having to journey long distances, and we hope that these activities will develop accordingly.

The last issue of the *British Fern Gazette* has been accepted as a great success, and there has been a healthy increase in our membership. We hope this will continue, for the stronger we are the better our services will be.

At the A.G.M. on 17th September we had to accept with regret the resignation of Mr. T. H. Bolton from the Presidency of the Society. He has held the office for two years and we thank him for his services to us during this period. In his place, Professor R. E. Holttum was elected President and we welcome him to this office; Mr. Bolton becomes a Vice-President. Dr. Davidson was elected a Vice-President, and Mr. R. F. Cartwright was elected to the Committee. A complete list of the Officers and Committee appears on the front inside cover.

We are re-writing our Constitution, but were unable to get it completed before the A.G.M. Copies will be sent to members well before the next meeting when it will be submitted for approval.

The state of our finances formed an important part of the discussions. The appended financial statement shows a great increase in expenditure, which is inevitable if we want to develop the usefulness of the Society. But our income must also increase, and there are two courses open to us — increase our membership or raise the subscription rate. We do not feel the time is propitious for the latter course, although in the next year or so when our annual programme is more fully developed, we shall have to give it

serious consideration. In the meantime everyone can help to increase our membership by bringing the Society to the notice of friends interested in ferns and recruiting them to our ranks.

It was pointed out that members could always consider leaving a small legacy to the Society in their wills. A painless method and one worth thinking about!

Finally, prompt payment of subscriptions helps us greatly, and those who have not already done so, are asked to give this their attention now.

FINANCIAL STATEMENT at 30th JUNE 1960

as presented and accepted at the A.G.M. on 17th September 1960

1959 30th June	£	s.	d.		£	s.	d.
To Balance	87	3	5	Gazette Vol. 9, No. 1	82	15	0
Subscriptions	57	10	0	Subscriptions to:			
Sale of:				R.H.S.	2	2	0
Gazettes	8	14	2	Council for Nature	2	0	0
Books		13	0	Stansfield Medal to Rev. E. A. Elliot	2	10	0
Advertisements in Gazette ...	3	0	0	Stationery	5	4	11
				Advertisement in A.G.S. Bulletin	1	10	0
				Postages and Incidental Expenses:			
				Secretary	7	5	0
				Editor	1	10	0
				Balance	52	3	8
	£157	0	7		£157	0	7
1960 30th June							
To Balance	52	3	8				

(signed) J. W. DYCE, Hon. Treasurer
(signed) PETER TEMPLE, Hon. Auditor

REQUESTS FROM MEMBERS

Our member, Mr. C. J. Taylor, 211 Arundel Street, Landport, Portsmouth, Hants. is anxious to obtain spores of the Mexican Tree Fern (*Cibotium schiedei*) and would be pleased to hear from any one knowing a possible source.

Mr. Neill D. Hall, 1225E., 95 Street, Seattle 15, Washington, U.S.A., would like to hear from any members interested in exchanging fern spores.

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NEW SERIES

VOL. 9 PART 2 APRIL, 1961

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VOLUME NINE PART THREE

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THE
BRITISH FERN GAZETTE

VOL. 9 MAY 1962 PART 3

THE POLYPODIUM VULGARE COMPLEX

M. G. SHIVAS (MRS. TREVOR WALKER) *Botany Dept., King's College, Newcastle*

Polypodium vulgare sensu lato is one of the most familiar of British ferns. It has been described and illustrated in many of our old herbals and was locally prized for its medicinal properties in the treatment of various ailments. Britten (1882) for example quotes its cure in several parts of Great Britain and Europe as a purgative and as a cure for various lung disorders, colds, whooping cough etc.

In more recent times *P. vulgare* has been of considerable interest to fern collectors in this country as a source of morphological variations of horticultural and decorative value. Many forms and varieties have been named, most of which have been based on some unusual feature such as the presence of very deep serrations, pronounced auricles etc. An extensive collection of examples of this kind may be seen in Thomas Moore's herbarium at Kew. Such forms are genetically monstrous types and are of little or no biological importance.

During the past few years *P. vulgare* has been studied cytologically and experimentally (Manton, 1950; Shivas, 1961 a and b) and it has been shown that it is not a single entity but is in fact a complex of three different species. All three members of the complex differ from one another in chromosome number, morphology, ecology and geographical distribution. Furthermore, hybrids between them are not fertile, hence they are separated from one another by sterility barriers. All these features, taken in conjunction with the results of experimental work, have led to the recognition of the members of the complex as distinct species. These have been named *P. australe* Fée, *P. vulgare* L. and *P. interjectum* Shivas.

Polypodium australe is a diploid species having 37 gametophytic (i.e., prothallial) chromosomes and 74 in the sporophyte (i.e., the dominant stage of the life cycle of the fern). It is the most southerly member of the complex in its geographical distribution, being found mainly in southern Europe and the Mediterranean region. It does, however, extend into parts of England,

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Wales and Ireland — this representing its most northerly limits. In Britain it frequently occurs in limestone habitats, as is the case with many other plants near the limits of their geographical range.

P.vulgare sensu stricto is a tetraploid species with 74 gametophytic and 148 sporophytic chromosomes. It has the widest European distribution of all the members of the complex and is undoubtedly the plant that Linnaeus himself knew since it is the commonest (and most probably the only) *Polypodium* in Sweden. It is both common and widespread in Britain.

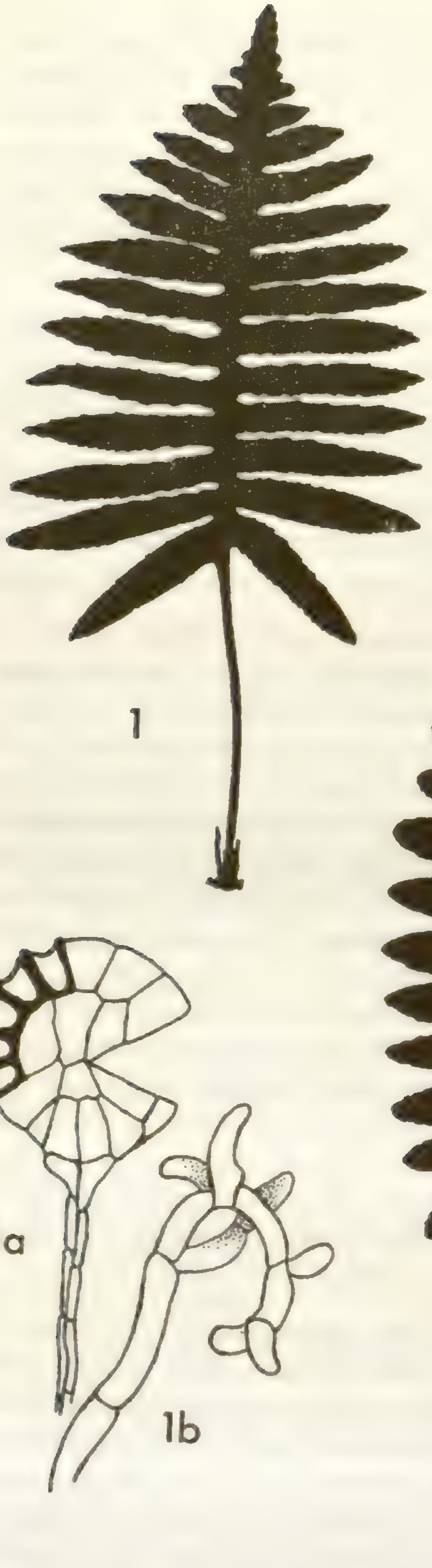
P. interjectum is a hexaploid with a gametophytic chromosome number of 111 and a sporophytic number of 222. Its European range is intermediate between those of the other two species. It is common in Britain and appears to favour rather damper habitats, often showing luxuriant growth under wet conditions.

By making crosses involving all possible combinations of these species and then analysing the behaviour of the chromosomes at meiosis in the hybrids one can make deductions concerning the interrelationships of the parental species. Such techniques have shown that *P. vulgare* and *P. australe* are not very closely related, despite their superficial similarity. In the past these two species have crossed, however, to give rise to a sterile triploid hybrid which completely fails to pair its chromosomes at meiosis. The doubling of the chromosome complement of such a hybrid leads to the formation of a fertile hexaploid in which meiosis is normal. This hexaploid is *P. interjectum.*

In North America there are several species of *Polypodium,* some of which belong to the *P. virginianum* complex, and others which are closer to the *P. vulgare* in morphology. It is now known (from the type of experiment described above) that the European *P. vulgare* sensu stricto has at least one, and most probably two, of these American species in its parentage. Thus one has the rather curious situation that the European *P. vulgare* is derived from American diploid ancestors, despite that fact that there is a diploid species in Europe in the form of *P. australe.* Since *P. interjectum* is a hexaploid derived from *P. australe* and *P. vulgare* it follows that this species has a mixed European and American ancestry.

P. vulgare is the easiest member of the complex to identify in the field, differing markedly from the other two species in frond and soral characters. The fronds of this species are lanceolate, bearing pinnae which are all more or less of equal length from the base to near the tip of the frond. The lamina is completely flat. The sori are round and the sporangia mature in the summer.

Both *P. australe* and *P. interjectum* have sori which are oval in outline when young, but the sporangia of *P. interjectum* mature in summer and autumn whilst those of *P. australe* mature in the autumn or the following spring.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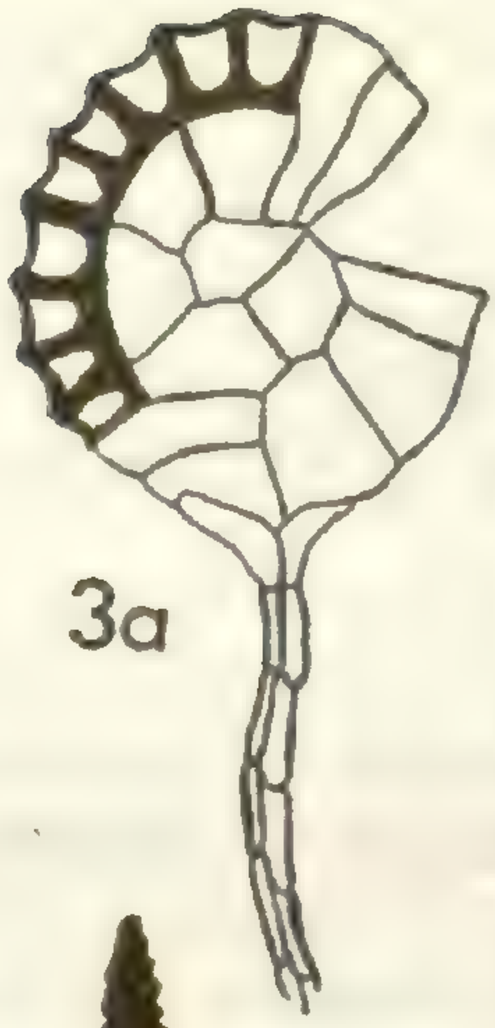
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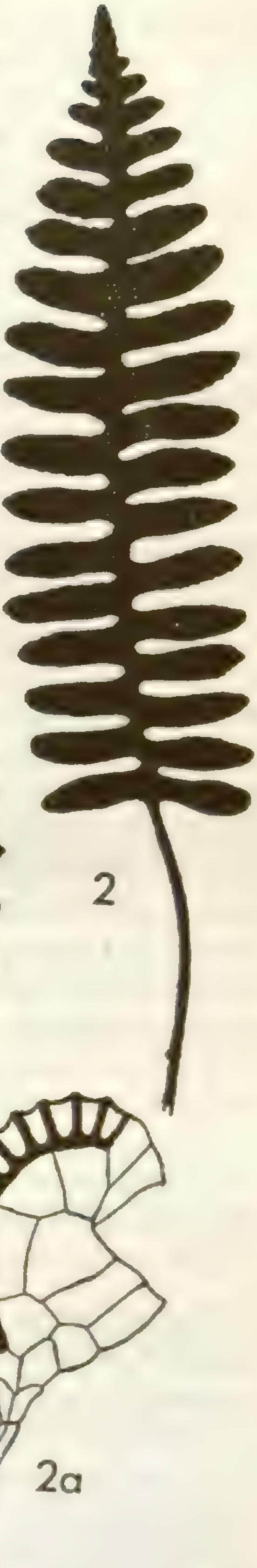
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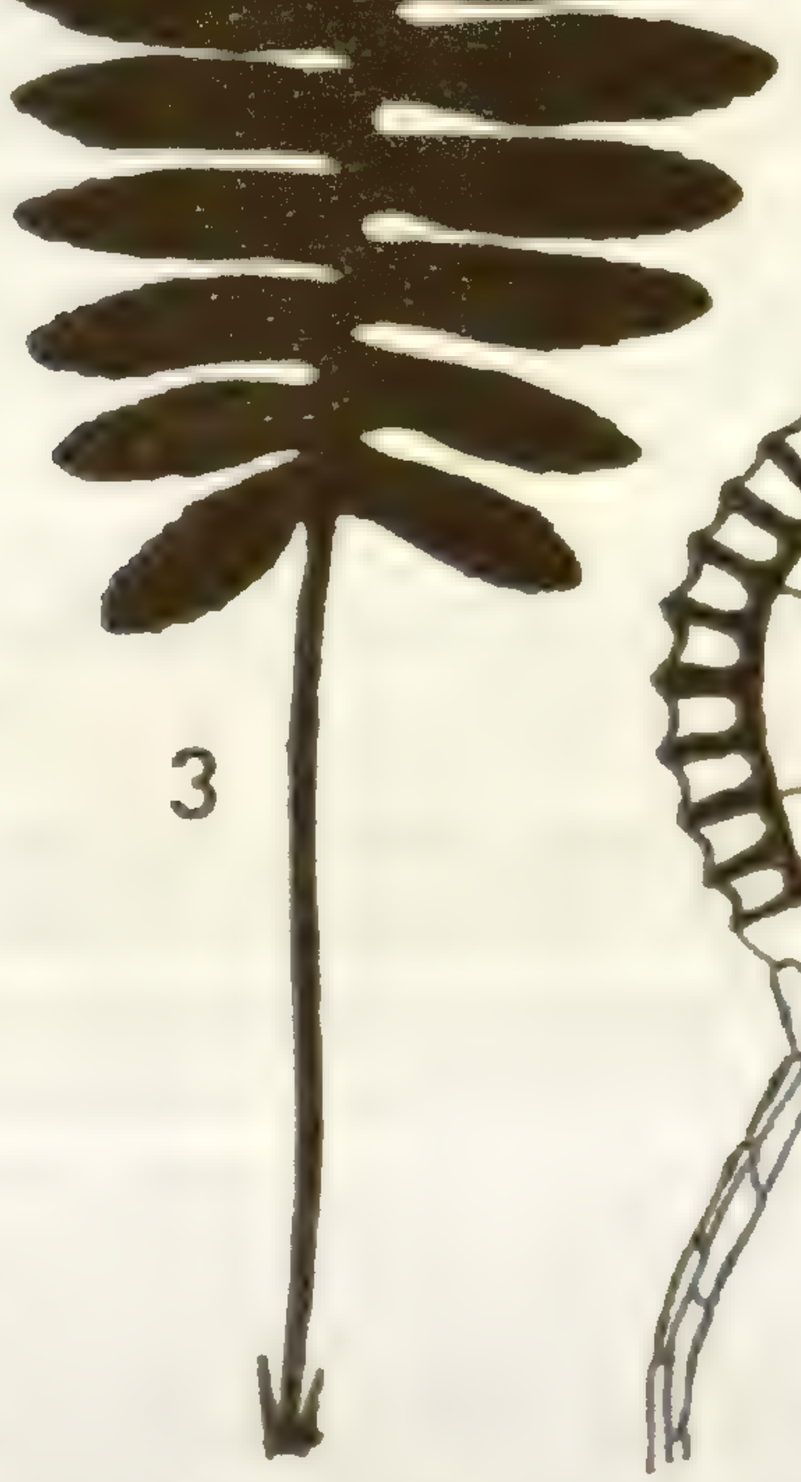
3

2a

Frond silhouettes [x ½] and sporangia [x 60] of *Polypodium*.
FIG. 1 : *P. australe* Fée (with paraphysis, 1b) ; FIG. 2 : *P. vulgare* L. ;
FIG. 3 : *P. interjectum* Shivas.

The fronds of *P. australe* are produced in the autumn and are broadly ovate, almost triangular. In this species it is usually the second pair of pinnae from the base which is the longest. In *P. interjectum* the new fronds are produced in both summer and autumn and are ovate — the longest pair of pinnae being the 4th, 5th or 6th from the base. In both species the lowest pair of pinnae are markedly inflexed — a very conspicuous character in the field but which, however, tends to be lost on herbarium specimens.

In addition to the macroscopic characters mentioned above which can be used both in the field and in the herbarium there are several other features which require the use of a microscope of low magnification. These features provide very useful checks on identifications made in the field.

Martens (1950) described the presence of branched paraphyses intermixed with the sporangia of some European plants of *Polypodium* and it is now known that these are diagnostic of *P. australe*, the other two species lacking them (see fig 1b)

The number of the conspicuously thickened cells of the sporangial annulus — the indurated cells — varies from one species to the next, as has been noted by Futo (1905) and Manton (1950), and therefore provides a good identification character. *P. australe* has an average of 4 - 7 indurated cells in the annulus, *P. vulgare* has 10 - 14, whilst *P. interjectum* is intermediate with 6 - 10. In addition to this Mr. P. Benoit has drawn my attention to the fact that the indurated cells of *P. vulgare* turn a much darker brown and are more conspicuous than is the case in *P. interjectum*. The contrast in colour between the indurated cells and those of the rest of the sporangium is so marked that the dark brown line of the annulus in *P. vulgare* is easily seen with a $\times 10$ lens or even with the naked eye. The reasons for this lies not only in the greater number of indurated cells in *P. vulgare* but also in the fact that after dehiscence the sporangia gape open and expose the whole of the annuli to view. This is in contrast to the sporangia of *P. interjectum*, which not only have fewer indurated cells per annulus but also do not open widely at dehiscence and hence part of the annulus is concealed. I am very grateful to Mr. Benoit for these observations and for allowing me to quote him.

Rhizome scales are often used as specific characters in ferns and an examination of these have been made in each of these three species. The variation in shape of the scales around the base of the youngest frond has been found to be so wide that without a statistical analysis this character would not be useful. However, there is a strong tendency for *P. australe* to have a long tapering, almost linear, scale whereas *P. vulgare* has a narrow triangular scale drawn out to an accuminate tip which is rarely longer than the triangular area itself. The scales of *P. interjectum* are, as one might expect, intermediate between the other two — the drawn out tip being at least $1\frac{1}{2}$ times as long as the triangular portion. This character can sometimes be used as a confirmatory character on sterile plants, and for that reason is included here.

Finally, spore size also varies, being on average greater than 74μ in length in *P. interjectum*, less than 74μ in *P. australe* and less than 70μ in *P. vulgare*.

One final advantage in the use of a microscope should be noted and this is in the diagnosis of hybrids. Where any two species of *Polypodium* grow together hybrids may be formed and all three possible types are known from the wild, namely the triploid *P. australe* × *P. vulgare*, the tetraploid *P. australe* × *P. interjectum* and the pentaploid *P. vulgare* × *P. interjectum*. These may be rather difficult to distinguish from the true species with certainty as they combine the characters of the parents but all of them have irregular meiosis and as a consequence produce spores which are irregular in shape and size. A glance at mature spores of a suspected hybrid is sufficient to settle any doubts as to its nature. Triploid and tetraploid hybrids are infrequent because of the limited distribution of *P. australe;* the pentaploid more frequently occurs in mixed populations of the parental species.

These characters may be summarised in the form of two keys which readers may find easier in practice to use than a single combined key.

KEY TO MACROSCOPIC CHARACTERS

1 Sori round; fronds lanceolate, pinnae more or less equal in length to near the tip of the frond; lowest pair of pinnae not projecting forward; new fronds produced in the summer; indurated cells of the annulus deeper coloured than other cells of the sporangium and very conspicuous . *P. vulgare*

Sori oval; lowest pair of pinnae projecting forward 2

2 Frond ovate, longest pair of pinnae being the 4th, 5th or 6th from the base; new fronds produced in summer and autumn . . *P. interjectum*

Frond broadly ovate or triangular, longest pair of pinnae being the 2nd from the base; new fronds produced in the autumn . . . . *P. australe*

KEY TO MICROSCOPIC CHARACTERS

1 Paraphyses present; number of indurated cells averaging 4 - 7; mean spore length less than 74μ . . . . . *P. australe*

Paraphyses absent 2

2 Number of indurated cells averaging 10 - 14; mean spore length less than 70μ *P. vulgare*

Number of indurated annular cells averaging 7 - 10; mean spore length greater than 74μ . . . . . *P. interjectum*

At present an attempt is being made to record the occurrence of the three species of *Polypodium* in the British Isles and a table is given at the end of this paper summarizing our present knowledge by listing the vice-counties in which each of the species has been found.

As is the case with most common species of plants, however, we tend to have far less information concerning the detailed distribution and ecological

requirements of *Polypodium* than is the case for very rare plants. It is hoped that the descriptions and keys given above will be helpful to readers and encourage them to collect specimens and compile appropriate information on habitat etc., in an attempt to increase our knowledge of those ferns.

My grateful thanks are due to Mr. A. C. Jermy in preparing the distribution table and illustrations.

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DISTRIBUTION OF THE THREE POLYPODIUM SPECIES IN THE BRITISH ISLES

The numbers used refer to the Watsonian vice-counties as adapted for *A Preliminary Census List of British Pteridophytes* [Brit. Fern Gazette **9**(1) page 15 (1959)].

POLYPODIUM AUSTRALE Fée: 2, 3, 5, 6, 9, 35, 41, 45—47, 69; H3, 4, 7, 9, 12, 28, 29.

POLYPODIUM VULGARE L.s.s.: 0, 1—6, 8—12, 14—23, 24, 25, 27—29, 31—33, 35, 38—40, 42, 45, 47—50, 52, 54, 57, 58, 61, 64—67, 69—72, 74, 78, 80, 81, 83, 87—93, 96, 97, 100—102, 104—106, 108, 110—112; H1—4, 16, 29, 33, 35.

POLYPODIUM INTERJECTUM Shivas: 0, 1—6, 9—11, 13—18, 22—25, 27—29, 32, 34, 35, 38, 41—47, 49, 50, 52, 58, 64, 67, 69—71, 83, 92, 98, 99, 101, 102, 104, 108, 110; H2—6, 8, 12, 23.

N.B. The apparent scarcity of these species in Ireland is due to the fact that little Irish aggregate material has been re-determined. Further material and records will be welcomed from all areas either on a vice-county or 10-km. grid square basis.

A REVISED LIST OF PTERIDOPHYTES FROM ST. KITTS

G. R. PROCTOR

Kingston, Jamaica, W.I.

The Lesser Antillean island of St. Kitts (St. Christopher), one of the verdant chain of tropical volcanic peaks that rim the Caribbean Sea along its eastern end, has a long but intermittent history of botanical investigation. From the time of Sir Hans Sloane, who collected the first ferns there in 1687, relatively few botanists have visited St. Kitts, and these for the most part at long intervals. It is not surprising, therefore, that today a collector can still make significant contributions to our knowledge of the flora, in spite of the small area involved.

Until the present century, there was little systematic search for ferns. Until recently, our knowledge was chiefly based on the collections made by N. L. Britton & J. F. Cowell in 1901, and H. E. Box in 1931 - 32. The present writer was able to make several visits to the island in 1958 and 1959, during the course of field work[1] connected with the preparation of a " Flora of the Lesser Antilles," for which the volume on ferns is nearly ready for publication.

In 1937 (Journ. Bot. **75**:241–258 *t. 612*), H. E. Box and the late A. H. G. Alston published the first comprehensive list of the pteridophytes known from St. Kitts. A total of 97 species were enumerated. Most of these had been collected by Mr. Box (whose specimens are deposited at the British Museum), but a few other records of earlier collectors were also included.

The present writer's work has resulted in the addition of 32 species not specifically listed or authenticated before, including two that have proven new to science. It therefore seems desirable at this time to present a new augmented St. Kitts' list, not only for the sake of completeness, but also to record certain nomenclatural changes that will be adopted for " Flora of the Lesser Antilles."

The present catalogue cannot presume to improve on Mr. Box's excellent account of the St. Kitts' vegetation in relation to the fern flora, but a few minor discrepancies of detail which appear therein can be mentioned for the sake of accuracy.

Firstly, there seems to have been inadequate liaison between Box's descriptive section and Alston's list, as several names of ferns mentioned in the former either do not appear at all in the latter, or else in the form of synonyms. *Anemia adiantifolia*, *Diplazium striatum*, *Dryopteris megalodus*, and *Hymenophyllum hirtellum* are examples of the first category; *Dryopteris mollis* (=*D. quadrangularis*), *Diplazium arboreum* (=*D. cristatum*), and *Olfersia cervina* (=*Polybotrya cervina*) are examples of the second. It is difficult to understand how these were editorially passed without correction.

[1] Supported by National Science Foundation Grant No. G 4441, in collaboration with Dr. R. A. Howard, Arnold Arboretum of Harvard University.

In addition, there are several references to a palm called " *? Acrista monticola* " which apparently allude to the well-known *Euterpe globosa Gaertn.*, a common species of the moist forests at middle to higher elevations.

Finally, the plant called *Columnea hirsuta* cannot be that species, which is endemic to Jamaica. No *Columnea* is in fact recorded for St. Kitts; Box's plant was probably the common and striking *Alloplectus cristatus* (L.)Mart. var. *brevicalyx* Morton, which resembles a *Columnea* in habit.

A further descriptive point is that following a small earthquake during a period of heavy rains in 1960, a great landslide occurred in the crater below Mt. Misery; this completely filled up the lake which formerly occupied part of the floor of the crater. The vegetation inside the crater has therefore suffered considerable destruction and change since so ably described by Mr. Box.

In the present list, the nomenclature is given in accordance with the treatment in the forthcoming " Flora of the Lesser Antilles," and therefore indicates the writer's present views, especially on the names and delimitation of genera. Within the families, the genera and species are listed in alphabetical order. In each instance, the accepted name is given first in small capitals (new names or combinations in bold face); if the name was not the same in Alston's list, the one he used follows parenthetically in italics. Box's localities and numbers are then cited (or others if any), followed by those of the present author. Names of species or other taxa here newly recorded for St. Kitts are preceded by an asterisk. I am indebted to Dr. W. T. Stearn of the British Museum (Natural History) for his help in preparing the Latin description, and to Dr. K. U. Kramer and Mr. Wessels Boer of the State University of Utrecht for several useful comments and determinations.

The specimens collected by the writer are deposited in duplicate at the Harvard University Herbarium and the Institute of Jamaica. Further sets have been sent to the State University of Utrecht and the U.S. National Herbarium.

The total number of pteridophyte species now known from St. Kitts is 129, all occurring in an area roughly fourteen miles long and five miles wide, of which more than half, being cultivated with sugar cane, is nearly devoid of ferns. With the exception of the peculiar *Asplenium* described here as new, there appear to be no species endemic to this island, though several are shared only with others of the Lesser Antilles.

PSILOTACEAE

PSILOTUM NUDUM (L.)Griseb. Wingfield, *Box 367;* Wingfield Ravine, on shaded vertical cliff of volcanic conglomerate, *Proctor 19242.*

LYCOPODIACEAE

LYCOPODIUM CERNUUM L. *Masson* (BM); floor of The Crater, *Proctor 19238* (growing beside *L. tortum* and perfectly distinct from it; Alston's suggestion that the two are merely eco-variants will not hold).

*L. CLAVATUM L. Floor of The Crater, *Proctor 19239;* upper slopes and summit of Mt. Misery, *Proctor 19617.*

L. DICHOTOMUM Jacq. *Britton & Cowell 304* (not seen).

L. SIEBERIANUM Spring. Mt. Misery, *Britton & Cowell 547* (not seen).

L. TAXIFOLIUM Sw. Olivee's Mt., *Box 401;* Nine Turn Gut, *Proctor 19569.*

L. TORTUM Sieber ex Underw. & Lloyd. Rim of The Crater, *Box 269, Proctor 19217;* Olivee's Mt., *Box 395.*

SELAGINELLACEAE

SELAGINELLA FLABELLATA (L.)Spring. Mt. Misery, *Box 258;* Molyneux Water Source, *Proctor 19278.*

*S. PLANA (Desv.)Hieron. Extensively naturalized on moist banks, Molyneux Water Source, *Proctor 19287.*

S. ROTUNDIFOLIA Spring. Upper slopes of Mt. Misery, *Box s.n.*

S. SUBSTIPITATA Spring. Mt. Misery, *Box 292* and *s.n.;* Olivee's Mt., *Box 394;* NW rim of The Crater, *Proctor 19496.*

S. TENELLA (Beauv.)Spring. Nine Turn Gut, *Box 351;* Wingfield Ravine, *Proctor 19241;* Molyneux Water Source, *Proctor 19277.*

*MARATTIACEAE

*DANAEA NODOSA (L.)J.E.Sm. Outer NW slopes of The Crater, *Proctor 19535.*

*SCHIZAEACEAE

*ANEMIA ADIANTIFOLIA (L.) Sw. Mentioned in the descriptive section (p. 246 of Box & Alston's paper, but not included in the annotated list. Phillips Level, on a ruined overgrown wall, *Proctor 19546.*

GLEICHENIACEAE[1]

GLEICHENIA BIFIDA (Willd.)Spreng. (*Dicranopteris bifida* (Willd.) Maxon) Edge of the Crater Lake, *Box 257;* NW rim of The Crater, *Proctor 19222.*

G. FURCATA (L.)Spreng. (*Dicranopteris furcata* (L.)Underw.). Mt. Misery, *Britton & Cowell* (not seen), *Box 290;* NW rim of The Crater, *Proctor 19224.*

HYMENOPHYLLACEAE

*HYMENOPHYLLUM ELEGANS Spreng. NW rim of The Crater, *Proctor 19515.*

*H. FUCOIDES (Sw.)Sw. NW rim of The Crater, *Proctor 19512.*

*H. HIRSUTUM (L.)Sw. var. HIRSUTUM (the typical form not listed by Alston). Outer NW slopes of The Crater, *Proctor 19522.*

H. HIRSUTUM var. **gratum** (Fée)Proctor, **comb. nov.**, based on *H. gratum* Fée, Mém. Foug. **11**:118, *t. 30, f. 1*, but excl. *f. 2* (1866). (Listed as *H. gratum* by Alston). " Near the crater," *Box 253;* outer NW slopes of The Crater, *Proctor 19523.*

[*H. hirtellum* Sw. was listed by Box in his descriptive section (p. 249), but not cited by Alston. Probably a misidentification for *H. hirsutum* var. *gratum*, as Box called it " common." It is not unlikely, however, that true *H. hirtellum* may yet be found on St. Kitts, as there are authentic records from Saba and Guadeloupe.]

*H. LANATUM Fée. Candle Walk Ridge, along track to Dodans (Dos d'Ans) Pond, *Proctor 19581.*

[1] The generic concepts recognized in this family follow those of Holttum in Reinwardtia 4(2):257–280 (1957).

*H. LINEARE (Sw.)Sw. Vicinity of Dodans (Dos d'Ans) Pond, Verchild's Mt., *Proctor 19592.*

*H. MACROTHECUM Fée. Candle Walk Ridge, *Proctor 19571.*

H. POLYANTHOS (Sw.)Sw. Olivee's Mt., *Box 392-A;* NW rim of The Crater, *Proctor 19511.*

*H. SIEBERI (C.B.Presl)v.d.Bosch. NW rim of The Crater, *Proctor 19514.*

TRICHOMANES ALATUM Sw. " Near the crater," *Box 254;* Molyneux Water Source, *Proctor 19275.*

T. CRISPUM L. Ridge above the crater, *Box 271;* outer NW slopes of The Crater, *Proctor 19524;* Olivee's Mt., *Box 391.*

T. HYMENOPHYLLOIDES v.d.Bosch. Belmont, *Britton & Cowell* 410 (not seen); Wingfield Estate, *Britton & Cowell 452* (not seen); outer NW slopes of The Crater, *Proctor 19526.*

*T. KAPPLERIANUM Sturm. Wingfield Ravine, *Proctor 19269.* I am indebted to Mr. Wessels Boer, at the State University of Utrecht, for this determination. This species is similar to, and often confused with, the Greater Antillean *T. hookeri* C.B.Presl, under which name the present collection was distributed.

T. KRAUSII Hook. & Grev. (Alston, like some other recent authors, spells this species " *kraussii* "; however, the plant was named for a Dr. Kraus, who sent the type specimens from Dominica, and the original publication uses but one " *s* "). Olivee's Ravine, *Box 388;* Wingfield Ravine, *Proctor 19247.*

T. MEMBRANACEUM L. Nine Turn Gut, *Box 251;* interior slopes of The Crater, *Proctor 19229.*

T. POLYPODIOIDES L. Nine Turn Gut, *Box 252.*

*T. PUNCTATUM Poir. Molyneux Water Source, *Proctor 19276.*

T. ANGUSTIFRONS (Fée) Wessels Boer (*T. pusillum* Sw.). Olivee's Mt., *Box 402;* outer NW slopes of The Crater, *Proctor 19525.*

T. RIGIDUM Sw. Ridge above the crater, *Box 280;* NW rim of The Crater, *Proctor 19495.*

T. TRIGONUM Desv. Ridge above the crater, *Box 279;* outer NW slopes of The Crater, *Proctor 19205;* E spur of Mt. Misery, *Proctor 19613.*

CYATHEACEAE[1]

CNEMIDARIA GRANDIFOLIA (Willd.)Proctor. (*Hemitelia grandifolia* (Willd.) Spreng.). Ridge above the crater, *Box* 283; NW rim of The Crater, *Proctor 19501.*

CYATHEA ARBOREA (L.)J.E.Sm. Wingfield Ravine, *Box 377;* Olivee's Mt., *Box 397.*

C. MURICATA Willd. (*Hemitelia muricata* (Willd.)Fée). Above Belmont, *Box 281;* Olivee's Mt., *Box 398;* Wingfield Ravine, *Proctor 19642.*

POLYPODIACEAE *sens. lat.*

ADIANTUM TENERUM Sw. Wingfield Ravine, *Box 376.*

A. TETRAPHYLLUM Humb. & Bonpl. ex Willd. Nine Turn Gut, *Box 362;* Wingfield Ravine, *Box 372.*

A. VILLOSUM L. Canada Hills, *Box 348.*

ANETIUM CITRIFOLIUM (L.)Splitg. Nine Turn Gut, *Box 260, 353;* Wingfield Ravine, *Proctor 19258.*

*ASPLENIUM ABSCISSUM Willd. Wingfield Ravine, *Proctor 19248.*

A. AURITUM Sw. var. BIPINNATISECTUM Mett. This is the common variety of the species in the Lesser Antilles, where the typical form (var. *auritum*) does not

[1] The generic concepts recognized in this family follow those of Copeland, Gen. Fil: 94–99 (1947).

occur. It is sometimes listed as *A. auritum* [α] var. *rigidum* (Sw.) Hook. (1860), but this epithet is antedated in varietal status by that of Mettenius (1859). In order to fix quite definitely the application of Mettenius' name, from his numerous citations *Bory, s.n.*, from Guadeloupe is hereby selected as lectotype. (Listed simply as *A. auritum* by Alston). Nine Turn Gut, *Box 259;* lower (E) slopes of Mt. Misery, *Box 297;* along track from Belmont Estate to The Crater, *Proctor 19537.*

A. CRISTATUM Lam. Wingfield, *Box 368;* Wingfield Ravine, *Proctor 19265.*

*A. LAETUM Sw. Wingfield Ravine, *Proctor 19252.*

*A. **malcolm-smithii** Proctor, **sp.nov.**[1]

Rhizome erect or oblique, 5 - 6 mm. thick, clothed at apex with dusky-brown, clathrate, narrowly deltate scales 2.5 - 4 mm. long, 0.5 - 0.9 mm. broad at base. *Fronds* erect, 30 - 45 cm. long; *stipes* 8.5 - 14 cm. long, minutely glandular-pubescent toward base, broadly sulcate above and narrowly green-marginate. *Blade* pinnate, lanceolate, narrowly lance-oblong, or narrowly elliptic-oblong, 25 - 28 cm. long, 6 - 11.5 cm. broad, slightly reduced toward base, acuminate at apex; *rhachis* narrowly green-winged upwardly. *Pinnae* 16 - 20 pairs, opposite or alternate, trapezio-oblong, horizontal or the lower ones deflexed, of irregular length, 3 - 6 cm. long, 1 - 1.6 c.m. broad near the inequilateral sessile base, acuminate to caudate, the margins obliquely crenatedentate, the teeth chiefly 1.2 - 1.7 mm. broad at base. *Veins* oblique, the the lowest acroscopic one 2-forked, the middle ones on both sides 1-forked, those toward the apex simple. *Sori* 6 - 11 pairs, 2.5 - 5.5 mm. long, inframedial; *indusium* hyaline, entire, concealing the sporangia; *spores* abortive.

TYPE from interior slopes of The Crater, St. Kitts, elev. 2100 - 2500 ft., *Proctor 19234*, collected 22nd February, 1959, on moist shaded ledges. Holotype at the British Museum (Natural History); isotypes at the Harvard University Herbarium and the Institute of Jamaica.

Named for the late Mr. Malcolm Smith of Basseterre, St. Kitts, whose keen interest in mountain-climbing and in natural history have substantially contributed to our knowledge of his native island, both directly through observations and collections, and indirectly through his hospitality to and encouragement of visiting naturalists. It is appropriate to associate his name with a plant found in the beautiful forested crater he loved so much.

It seems possible that *A. malcolm-smithii* may be a hybrid between *A. abscissum* and *A. pseuderectum*, both of which occur in St. Kitts. The irregular pinnae and abortive spores suggest hybrid origin, and the following table illustrates the intermediate nature of the new species between its possible parents:

	abscissum	*malcolm-smithii*	*pseuderectum*
scales:	c. 1.5 mm. long	2.5 - 4 mm.	to 7 mm. long.
stipe:	7.5 - 20 cm. long	8.5 - 14 cm.	5 - 10 cm.
rachis:	green-marginate	narrowly green-winged upwardly	green-winged.
blade:	deltate-oblong to ovate-oblong	lanceolate to narrowly lance-oblong	linear.
pinnae:	5 - 9 pairs	16 - 20 pairs	25 - 40 pairs.
margins:	doubly or triply dentate-serrate	obliquely crenate-dentate, teeth 1.2 - 1.7 mm. broad	obliquely crenate-dentate, teeth 1.5 - 2.5 mm. broad.
veins:	1-3-forked	2-forked at base, 1-forked in middle, simple toward apex	mostly simple.
sori:	to 9 mm. long	2.5 - 5.5 mm.	2 - 4 mm. long.

[1] *Rhizoma* erectum vel obliquum, 5 - 6 mm. crassum, *paleis* fusco-brunneis clathratis anguste deltatis 2.5 - 4 mm. longis basi 0.5 - 0.9 mm. latis ad apicem vestitum. *Folia* erecta, 30 - 45 cm. longa; *stipes* 8.5 - 14 cm. longus, basim versus minute glanduloso-pubescens, superne late sulcatus, sulco lineis angustis viridibus marginato; *lamina* pinnata, ambitu lanceolata, anguste lanceolato-oblonga vel anguste elliptico-oblonga, 25 - 28 cm. longa, 6 - 11.5 cm. lata, basim versus leviter angustata, apice acuminata; *rhachis* sursum anguste viridi-alata; *pinnae* 16–20–jugae, oppositae vel alternae, horizontales vel inferiores deflexae, trapezio-oblongae inaequales, 3 - 6 cm. longae, basim sessilem inaequilateralem versus 1 - 1.6 cm. latae, acuminatae vel caudatae, margine oblique crenato-dentatae, dentibus basi 1.2 - 1.7 mm. latis; *venae* obliquae, infimo acroscopico bifurcato, mediis utrinque unifurcatis, eis apicem versus simplicibus. *Sori* 6–11–parii, inframediales, 2.5 - 5.5 mm. longi; *indusia* hyalina, integra, sporangia occultantia; *sporae* abortivae.

*A. PSEUDERECTUM Hieron. Interior slopes of The Crater, *Proctor 19231.*

A. PUMILUM Sw. Canada Hills. *Box 349.*

A. SALICIFOLIUM L. Nine Turn Gut, *Box 265;* Wingfield Ravine, *Proctor 19257.*

BLECHNUM DIVERGENS (Kunze)Mett. (*Struthiopteris exaltata* (Fée) Broadh.). Mt. Misery, *Box 311;* outer NW slopes of The Crater, *Proctor 19200.*

B. NESIOTICUM Kramer (*Struthiopteris striata* (Sw.) Broadh.). Ridge above the crater, *Box 284;* NW rim of The Crater, *Proctor 19223;* Mt. Misery, *Box 296.*

B. OCCIDENTALE L. Wingfield Ravine, *Box 370*; Wingfield, *Box 409;* Phillips Level, *Proctor 19553.*

*B. PLUMIERI (Desv.)Diels. NW rim of The Crater, *Proctor 19507.*

*B. UNDERWOODIANUM (Broadh.)C.Chr. E spur of Mt. Misery, *Proctor 19611.*

BOLBITIS CLADORRHIZANS (Maxon)Ching. Olivee's Ravine, *Box 381;* Wingfield Ravine, *Proctor 19262.*

CHEILANTHES MICROPHYLLA Sw. Canada Hills, *Box 350.*

COCHLIDIUM SEMINUDUM (Willd.)Maxon. Mt. Misery, *Box 312;* Verchild's Mt. near Dodans Pond, *Box 359;* NW rim of The Crater, *Proctor 19502, 19520.*

CTENITIS MERIDIONALIS (Poir.)Ching (*Dryopteris meridionalis* (Poir.)C.Chr.). Wingfield Ravine, *Box 364;* The Hole, West Farm, *Proctor 19633.*

DIPLAZIUM CRISTATUM (Desr.)Alston. Mentioned in the descriptive section by Box (p. 247) under the name *D. arboreum.* Nine Turn Gut, *Box 357;* Wingfield Ravine, *Box 373, Proctor 19261;* interior slopes of The Crater, *Proctor 19230.*

*D. STRIATUM (L.)C.B.Presl. Mentioned in the descriptive section by Box (p. 247), but not listed by Alston. Outer NW slopes of The Crater, *Proctor 19198;* Wingfield Ravine, *Proctor 19263.*

ELAPHOGLOSSUM APODUM (Kaulf.)Schott. NE slopes of Mt. Misery, *Box 278;* outer NW slopes of The Crater, *Proctor 19197.*

*E. BORYANUM (Fée)T. Moore. Outer NW slopes of The Crater, *Proctor 19202, 19204.*

E. CRINITUM (L.)Christ (*Hymenodium crinitum* (L.)Fée). NE slopes of Mt. Misery, *Box 274;* outer NW slopes of The Crater, *Proctor 19528.*

E. DUSSII Underw. NE slopes of Mt. Misery, *Box 275;* NW rim of The Crater, *Proctor 19218.*

*E. HERMINIERI (Bory & Fée)T. Moore. Phillips Level, *Proctor 19550.*

*E. IMPRESSUM (Fée) T. Moore. NW rim of The Crater, *Proctor 19210.*

*E. LONGIFOLIUM (Jacq.)J.Sm. NW rim of The Crater, *Proctor 19225.*

E. MARTINICENSE (Desv.)T. Moore (*E. underwoodianum* Maxon). Olivee's Mt., *Box 396;* Phillips Level, *Proctor 19552.*

*E. PLUMIERI T. Moore. NW rim of The Crater, *Proctor 19503.*

E. UNDULATUM (Willd.)T. Moore. Mt. Misery, *Box 298.*

✓GRAMMITIS **asplenifolia** (L.)Proctor, **comb. nov.,** based on *Polypodium asplenifolium* L., Sp. Pl. 1084, *excl.* β (1753). This species has often been confused with the plant named *Polypodium suspensum* by Linnaeus, but the two are entirely distinct, as should be evident to anyone who takes the trouble to compare the Linnaean descriptions and the Plumier plates on which they are ultimately based. Our present species is the abundantly hairy one illustrated by Plumier (Tr.Fil.Amer. *t. 102 - A*) under the name *Asplenium altius & villosum*, and which Petiver copied as his *Polypodium asplenii folio villoso* (Fil. 26, *t. 7 - f*). Petiver's copy is the actual Linnaean type. Plumier originally obtained his material from Morne de la Calebasse, Martinique, which must be considered the type locality. The present writer has recently re-collected this species at the same place in Martinique, where it is common. St. Kitts: ridge above the crater, *Box 272;* NW rim of The Crater, *Proctor 19216;* Olivee's Mt., *Box 393.*

*G. **eggersii** (Baker)Proctor, **comb. nov.** based on *Polypodium eggersii* Baker in Hook., Ic., Pl. *t. 1671* (1886). Closely related to *G. asplenifolia*, and might be treated as a variety of it, except that apparently it maintains identity without intergradation throughout its range. It is certainly not a mere juvenile state of *G. asplenifolia*, as considered by Copeland (Phil. Journ. Sci. **84**(4):443.(1956)). NW rim of The Crater, *Proctor 19226.*

G. MOLLISSIMA (Fée)Proctor (*Polypodium mollissimum* Fée). Mt. Misery, *Box 291;* Candle Walk Ridge, *Proctor 19577.*

*G. SERRICULA (Fée)Proctor. Vicinity of Dodans (Dos d'Ans) Pond, Verchild's Mt., *Proctor 19593.*

G. SERRULATA (Sw.) Sw. (*Polypodium duale* Maxon). Mt. Misery, *Box 293 & s.n.;* vicinity of Dodans (Dos d'Ans) Pond, Verchild's Mt., *Proctor 19594.*

G. **suspensa** (L.)Proctor, **comb. nov.,** based on *Polypodium suspensum* L., Sp. Pl. 1084 (1753); *Polypodium jubaeforme* Kaulf.; *Grammitis jubaeformis* (Kaulf.) Proctor. Although it is perfectly clear that the glabrous species named *P. suspensum* by Linnaeus (founded on Plumier, Tr.Fil.Amer. *t. 87*) cannot be synonymous with the hairy and larger *P. asplenifolium*, the present writer has been for long in doubt as to the former's real identity. The difficulty lies in the fact that the type is an illustration technically somewhat inadequate. The type locality, Morne de la Calebasse, Martinque, has produced probably more than one glabrous-fronded species of this affinity, and until recently the writer was of the opinion that an unusually large plant of " *P. flabelliforme* Poir." could have been the basis of the Linnaean species. A paper was actually written (but not published) in which this view was expounded at some length, but not without some private misgivings.

In December, 1960, an opportunity arose to spend nearly a week collecting on Morne [de la] Calebasse, and a special effort was made to rediscover the several Linnaean species of ferns founded on Plumier plates, which in turn were drawn from specimens collected at this locality. It can be stated in passing that most of them were in fact found, and there can be no doubt that the habitat has changed remarkably little since Plumier roamed these mossy woodlands in the 1680's.

However, not a single plant, large or small, of " *P. flabelliforme* " could be discovered (the name *flabelliforme*, usually applied to a rare fern of Guadeloupe and Martinique, was actually based on a specimen of a different species from Mauritius). On the contrary, the commonest species of this general relationship was the one long known as *P. jubaeforme* Kaulf. In fact, if this entity was even half as common in Plumier's day, he could hardly have failed to see it, and to record it. Yet the only one of his plates which can reasonably be equated with this species is " *Polypodium pendulum glabrum* " (Tr. Foug. *t. 87*, right-hand figure), upon which Linnaeus much later founded his *P. suspensum!* This seemed to be quite convincing, though perhaps not conclusive, evidence.

Somewhat later, Mr. C. V. Morton (who previously had read the writer's unpublished manuscript on this subject) wrote (personal communication) likewise suggesting *P. jubaeforme.* He also added that if the identity of the Linnaean *P. suspensum* could not be clearly settled, it might be better to treat it as a " nomen ambiguum," than to displace a well-established name. To the writer the latter solution seems unsatisfactory, as Plumier must have been dealing with a real plant. Recent examination of Plumier's original MS. drawing of *Polypodium pendulum glabrum* in the Bibliothéque Génerale, Muséum d'Histoire Naturelle at Paris, though still not conclusive, does give a somewhat clearer idea of the similarity to *P. jubaeforme;* at least, it does not suggest any possible alternative. The best course seems, therefore, to decide definitely that *P. suspensum* L. must reasonably be assumed the same as the later *P. jubaeforme* Kaulf. (of which the type also came from Martinque!) and it is herewith treated accordingly.

St. Kitts: Verchild's Mt., *Box 356;* E spur of Mt. Misery, *Proctor 19614.*

G. TAENIFOLIA (Jenm.)Proctor (*Polypodium taenifolium* Jenm.). Near the crater, *Box 255;* NW rim of The Crater, *Proctor 19227;* Olivee's Mt., *Box 391.*

G. TAXIFOLIA (L.)Proctor (*Polypodium taxifolium* L.). Ridge above the crater, *Box 270;* outer NW slopes of The Crater, *Proctor 19201.*

*G. TRIFURCATA (L.)Copel. NW rim of The Crater, *Proctor 19513.*

HEMIDICTYUM MARGINATUM (L.)Presl. Not found by Box or Proctor; listed by Alston on the basis of Hook., Exot. Ferns *t. 73* (1858). The presence of this species in St. Kitts is altogether probable; it has been collected recently as near as adjacent Nevis. The genus *Hemidictyum* seems doubtfully distinct from *Diplazium.*

HYPOLEPIS REPENS (L.)C.B.Presl. Phillips Level, *Box 264;* Molyneux Water Source, *Proctor 19280.*

*LINDSAEA QUADRANGULARIS Raddi, ssp. ANTILLENSIS Kramer. NW rim of The Crater, *Proctor 19499.*

LOMARIOPSIS SORBIFOLIA (L.)Fée (*Stenochlaena sorbifolia* (L.)J.Sm.). Nine Turn Gut, *Box 261;* Wingfield Ravine, *Proctor 19246;* Olivee's Mt., *Box 400.*

LONCHITIS HIRSUTA L. (*Anisosorus hirsutus* (L.)Underw. & Maxon). Olivee's Mt., *Box 382;* Wingfield Ravine, *Proctor 19251.*

NEPHROLEPIS BISERRATA (Sw.)Schott. Wingfield Ravine, *Box 365.*

N. RIVULARIS (Vahl)Mett. Olivee's Mt., *Box* 392; E. spur of Mt. Misery, *Proctor 19608.*

PITYROGRAMMA CALOMELANOS (L.)Link. Wingfield, *Box 407;* Hope Estate, *Box 408.*

P. SCHAFFNERI (Fée)Weatherby [?]. The writer is tentatively accepting this identification, but considers it doubtful. The species is currently being ascribed to a number of Lesser Antillean islands (St. Barthelemy, Antigua, Redonda, and Montserrat, in addition to St. Kitts) on the basis of specimens chiefly collected on cliffs, old walls, and other exposed places. They differ from typical *P. calomelanos* in having much shorter, more deltate blades, which tend to be more finely dissected (or rather, the divisions smaller and denser) and have the basal basiscopic pinnules of the lowest pinnae more or less elongate and deeply pinnatifid. However, these are characters that might be expected to appear in plants of *P. calomelanos* growing under difficult conditions. It should be remembered that the latter is a protean species capable of great variability; it has a deceptive plasticity of form, offering temptations which more than one fern taxonomist has been unable to resist. Typically, *P. schaffneri* is a species of Mexico and Central America. Though it must be admitted that the Leeward Islands plants now under discussion do resemble *P. schaffneri* in aspect, it remains to be proven that they are really conspecific. St. Kitts: walls of the crater, *Box 294;* NW rim of The Crater, *Proctor 19516;* Brimstone Hill, on walls of citadel, *Proctor 17501.*

POLYBOTRYA CERVINA (L.)Kaulf. Referred to by Box as *Olfersia cervina* (p. 247). N of the crater, *Box 288;* Nine Turn Gut, *Box 361;* Wingfield Ravine *Proctor 19245.*

POLYPODIUM ASTROLEPIS Liebm. Trail from Belmont to the crater, *Box 286;* Phillips Level, *Proctor 19568.*

P. AUREUM L. *Box*, sight record, not to be doubted.

P. LORICEUM L. Mt. Misery, *Box 300;* NW rim of The Crater, *Proctor 19494.*

P. LYCOPODIOIDES L. By side of Crater Lake, *Box 285;* Phillips Level, *Proctor 19565.*

P. PECTINATUM L. Nine Turn Gut, *Box 267;* Phillips Level, *Proctor 19556.*

P. PHYLLITIDIS L. Olivee's Ravine, *Box 385;* Phillips Level, *Proctor 19567.*

P. PILOSELLOIDES L. Trail from Belmont to the crater, *Box 286*, in part, not seen by Alston (det. Maxon); Phillips Level, *Proctor 19566.*

P. POLYPODIOIDES (L.)Watt. Wingfield Ravine, *Box 366.*

*P. REPENS Aub., *sens. lat.* Wingfield Ravine, *Proctor 19244.*

P. SECTIFRONS Kze. Mt. Misery, *Breutel*, not seen.

P. TRISERIALE Sw. (*P. brasiliense* Poir.). Nine Turn Gut, *Box 355.*

*POLYTAENIUM DUSSIANUM (Benedict)Benedict. Outer NW slopes of The Crater, *Proctor 19529.*

P. FEEI (Schaffn.)Maxon. Nine Turn Gut, *Box 262;* Wingfield Ravine, *Proctor 19260.*

PTERIS BIAURITA L. Recorded by Urban, Symb. Ant. **4**:48 (1903); along track between Molyneux and Phillips Level, *Proctor 19562.*

P. LONGIFOLIA L. Wingfield, *Box 405.*

P. SERRULATA L.fil. Wingfield, *Box 406.*

TECTARIA HERACLEIFOLIA (Willd.)Underw. Wingfield Ravine, *Box 369, Proctor 19646.*

T. INCISA Cav. (*T. martinicensis* (Spreng.)Copel.). Wingfield Ravine, *Box 379, Proctor 19641.*

T. PLANTAGINEA (Jacq.)Maxon. Nine Turn Gut, *Box 268, 352;* Wingfield Ravine, *Proctor 19249.*

T. TRIFOLIATA (L.)Cav. Nine Turn Gut, *Box 266, 358;* Wingfield Ravine, *Proctor 19253.*

THELYPTERIS ANTILLANA Proctor, in Rhodora **63**:33 (1961) (*Dryopteris oligocarpa* sensu Alston, non O. Ktze.). Mt. Misery, *Britton & Cowell 529;* upper SW spur of Verchild's Mt., along track to Dodans (Dos d'Ans) Pond, *Proctor 19587*, type collection. Known otherwise only from Dominica.

T. CLYPEOLUTATA (Desv.)Proctor (*Dryopteris l'herminieri*(O.Ktze.) C.Chr.). No precise locality, *Box 273;* outer NW slopes of The Crater, *Proctor 19203.*

T. DECUSSATA (L.)Proctor (*Dryopteris decussata* (L.)Urban). Recorded from St. Kitts by Urban, Symb. Ant. **4**:19 (1903); outer NW slopes of The Crater, *Proctor 19530.*

T. DENTATA (Forsk.)E.St.John (*Dryopteris quadrangularis* (Fée) Alston) Attempts to apply Alston's criteria for distinguishing West Indian material from the Arabian and African *T. dentata* have not proven successful, and it does not seem possible to maintain their separation. Admittedly, however, a great deal of variation occurs, which cytological and perhaps statistical techniques may eventually help to sort out. Meanwhile, the writer prefers to maintain the earliest name which applies to the group as a whole.

*T. GERMANIANA (Fée)Proctor. Outer NW slopes of The Crater, *Proctor 19199.*

T. GLANDULOSA (Desv.)Proctor. (*Dryopteris brachyodus* (Kze.) O. Ktze.) *Britton & Cowell 407* (not seen); Candle Walk Ridge, *Proctor 19580.*

T. GONGYLODES (Schkuhr)Small (*Dryopteris gongylodes* (Schkuhr)O. Ktze.). Edge of Crater Lake, *Box 256, Proctor 19236.*

T. INVISA (Sw.)Proctor (*Dryopteris oligophylla* Maxon). Wingfield Ravine, *Box 378;* Molyneux Water Source, *Proctor 19286.*

T. LIMBATA (Sw.)Proctor (*Dryopteris limbata* (Swartz)O. Ktze.). Mt. Misery, *Box 289, 295, 299; Proctor 19625;* NW rim of The Crater, *Proctor 19505.*

[*T. megalodus* (Schkuhr)Proctor is cited twice by Box in his descriptive section (p. 247, 250, as *Dryopteris megalodus*), but it is lacking from Alston's list. The writer has not so far been able to authenticate the record. Box may possibly have mistaken *T. glandulosa* for this species, as they have often been confused in herbaria.]

T. NEPHRODIOIDES (Klotz.)Proctor (*Dryopteris nephrodioides* f. *guadalupensis* (Fée)C.Chr.). Olivee's Ravine, *Box 387;* Olivee's Mt., *Box 399;* Wingfield Ravine, *Proctor 19256.*

T. OPPOSITA (Vahl)Ching (*Dryopteris opposita* (Vahl)Urban). Wingfield Estate, *Britton & Cowell 446* (not seen).

T. PATENS (Sw.)Small (*Dryopteris patens* (Sw.)O. Ktze.). Olivee's Ravine, *Box 380;* Molyneux Water Source, *Proctor 19288.*

T. POITEANA (Bory)Proctor (*Dryopteris poiteana* (Bory)Urban). Olivee's Ravine, *Box 386.*

*T. REPTANS (Gmel.)Morton var. TENERA (Fée)Proctor. Interior slopes of The Crater, *Proctor 19232.*

T. RETICULATA (L.)Proctor (*Dryopteris reticulata* (L.)Urban). Phillips Level *Box 263, Proctor 19554.*

T. SPRENGELII (Kaulf.)Proctor (*Dryopteris sprengelii* (Kaulf.) O. Ktze.). Wingfield Ravine, *Box 371;* Molyneux Ghaut, *Box 403;* Molyneux Water Source, *Proctor 19291;* Molyneux Estate, *Britton & Cowell 312* (not seen); Lambert Estate, *Britton & Cowell 637* (not seen).

T. TETRAGONA (Sw.)Small (*Dryopteris subtetragona* (Link)Maxon). Wingfield Ravine, *Box 374;* Millikan Estate, *Box 404;* The Hole, West Farm, *Proctor 19635.*

VITTARIA FILIFOLIA Fée. *Rodger 24* (BM).

V. LINEATA (L.)J.E.Sm. " Cheekles "(acc. Krug); outer NW slopes of The Crater *Proctor 19527.*

ABSTRACT

A revised and augmented list of St. Kitts pteridophytes is presented, adding 32 species to the known catalogue for a total of 129. One new species, *Asplenium malcolm-smithii* (p. 75) is described. The following are new combinations: *Hymenophyllum hirsutum* var. *gratum* (p. 73), *Grammitis asplenifolia* (p. 76), *G. eggersii* (p. 77), and *G. suspensa* (p. 77). The identity of *G. asplenifolia* and *G. suspensa* are discussed.

SHORT NOTES

" LASTREA DILATATA var. ALPINA "

In 1857 Thomas Moore (Handb.Brit.Ferns, 3 ed.:126) described a small form of *Lastrea dilatata* from Ben Lawers under the name var. *alpina.* Recently after much research into the relationship of this plant Dr. Stanley Walker has thought fit to raise it to specific rank and has named it *Dryopteris assimilis* S. Walker [Amer.J.Bot.**48**:607 (1961)]. It is hoped that more will be heard of the distribution of this (diploid) close relative of *D. dilatata* (Hoffm.) A. Gray.

The purpose of this note, however, is to report on another diploid (chromosome number counted) *Dryopteris* of the same complex found by myself in a wet wood on a steep hillside in Wester Ross. This fern may be *D. assimilis* but as we have only Moore's varietal description to go on I can only compare it with that. The scales are concolourous and the rootstock is definitely prostrate, creeping and branching with the fronds arising in tufts at the ends of the branches. The stalk, blade and even the scales all have stalked glands yet Moore (who loved his glands) never mentions them. I think this plant is possibly *D. spinulosa* (*lanceolatacristata*) var. *decipiens* (Syme) Druce but what relationship it bears to either *D. assimilis* (apart from being another diploid) or to *D. lanceolatocristata* only breeding experiments will show.

H. V. CORLEY

NOTES ON THE HISTORY OF BRITISH FERN SPECIES I: CONFUSION IN THE FILMY FERNS

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and

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In 1686 John Ray, the eminent English natural historian, published the first volume of *Historia Plantarum* in which he included (p. 141) an account of a filmy fern under the descriptive phrase-name *Adiantum petraeum perpusillum Anglicum foliis bifidis vel trifidis Newtoni*. Of it he says " This was first shown to me by a Mr. [James] Newton, who, in company with Mr. Lawson found it on Buzzard Rough Crag, near Wrenose [Wrynose] " in the English Lake District, in July 1682 and Ray's description of it makes it clear that Newton had found the plant we today call *Hymenophyllum wilsonii* Hooker. He mentions, however, that he had " heard that this little plant was found a few years ago by Mr. Daire [a London alchemist], near Tunbridge town in Kent ". In 1688 he published the second volume of his *Historia* containing an Appendix to his 1686 account and here (p. 1853) he explained that " Mr. Doody has told [and later showed] me this same little fern [i.e. *Adiantum petraeum* . . .] . . . at the house of Dr. Plukenet." Ray's description that followed and the origin of the material suggests *H. tunbrigense*. In the same year Ray published a work entitled *Fasciculus Stirpium Britannicarum* in which he again mentions his *Adiantum petraeum* . . . referring to the two accounts mentioned above for a " fuller description ". Thus, although by chance Ray had seen both species and published separate descriptions of them, it is clear that he considered them as one in 1688.

Ray begins to have doubts in 1689 when, in reply to Edward Lhwyd of the Ashmolean Museum, Oxford, who had sent him some Irish material, he writes that he " inclines towards the opinion of Dr. Plukenet who believes in two sorts " [of *Adiantum petraeum* . . .]. A year later in his *Synopsis Methodica Stirpium Britannicarum* Ray states that Dr. Plukenet, a doctor in Westminster, makes two species, one fitting the Newton material, the other corresponding to Mr. Dare's plant, and a written contribution by Plukenet to this effect was appended at the end of the *Stirpium Britannicarum*. Plukenet figures the two species in his *Phytographia* (1691):t.3,f.5 (which he names *Adiantum radicosum humisparsum Filicula pellucida nostras Coriandri foliolis mollicellis globuliferum* [=*H. tunbrigense*]) and f.6 (named *Adiantum radicosum erectius foliolis imis bisectis, caeteris vero integris tenuissime crenatis* [=*H. wilsonii*]) and these are the first drawings to be published of these two species. It should be noted that Plukenet used, in his phrase-name for the plant we now know as *H. wilsonii* the diagnostic character *erectius* and for that known as *tunbrigense*, *humisparsum* and his figures although of sterile material show well the habit of both species. The reproductive

structures of ferns were little understood at that time and it is not surprising that Plukenet did not look closely at the " Seed vessels " to see the difference in the indusium.

By 1696 it is apparent that Ray accepted Plukenet's views that two kinds of plants were involved, for in the second edition of the *Stirpium* published that year we find (on p. 47) a long comment on the two plants and of Lhwyd's Irish material he says ". . . a beautiful specimen of the former species [i.e. *H. wilsonii*]. . . ." Many botanists of the time used Plukenet's drawings for identification, thus the Rev. Adam Buddle correctly equated a specimen of *H. tunbrigense* (now in the Sloane Herbarium in the Brit.Mus. (Nat.Hist.)) with fig. 5 of Plukenet's tab. 3. Ray published a *Supplement* to his *Historia* in 1704 in which he equates Plukenet's second species (=*H. wilsonii*) with his *Adiantum petraeum* . . . and agrees that it is different from Dare's Tunbridge plant.

In 1700 James Petiver published a series of writings entitled *Musei Petiveriani* and listed (p. 73) Ray's second plant naming it *Darea Tunbrigensis minor* possibly being unaware of Plukenet's name for it. There is no doubt as to which plant he is referring as he says, " I gathered this elegant Plant *A.D.* 1698 from the Rocks near *Tunbridge-Wells*, in the same place where Mr. *George Dare*, *Apothecary*, had long before observed it "; a specimen is in his collections in Herb. Sloane (H.S.190f.96). A year later another name appeared in the literature namely in Morison's *Historia Plantarum* (3:627, s.15,t.7,f.49 [referred by the author as f.50, in error]). Morison quotes Ray's description of the Lakeland plant but only Plukenet's fig. 5 [=*tunbrigense*] but considers the plant to be a moss (a suggestion which Ray had made some years earlier) and named it accordingly[1]. His figure appears to represent two fronds of *H. wilsonii* and one of *H. tunbrigense*, all infertile.

Sherard, an English business man, had, in 1721, called over to England the German botanist Johann Dillenius who, amongst other tasks, was set to work on revising Ray's *Stirpium Britanicum*. The resulting book did not have Dillenius' name associated with it, however, and was published in 1724 as a third edition. In this, a book with a large and wide sale, Dillenius, under Ray's original name says, " whether it is truly the same and not such a distinct species it is at least a variety owing its distinction to age, place and circumstances thus arising[2]. He adds new localities: near Settle[3], Yorks; near Llanberis, Caerns.; and Cockbush,[4] near Chichester, Sussex.

In 1753 Carl Linnaeus published his celebrated *Species Plantarum* where, by inserting epithets in the margin of this work, he produced the basis for all modern (binomial) plant nomenclature. Under the name of *Trichomanes tunbrigense* he gives a brief description (which could be either species)

[1] " Muscus *palustris Anglicus foliis integris, bifidis et trifidis sparsim nascentibus* ".

[2] Utrumque enim idem est et non tam distincta species, quam varietas saltem est aetati, loco et accidentibus in de ortis differentiam debens.

[3] A Settle locality was reported for *H. wilsonii* in 1911.

[4] Cockbush: " Found also plentifully by *Mr. Rand*, in Company with *Mr. Sherard*, amongst Pebbles at *Cockbush* . . . on the Coast of Sussex ". This almost certainly refers to a misidentification (possibly the alga *Pelvetia canaliculata* [cf. Wolley-Dod, Fl. Sussex, 1937, who suggests the pebble area referred to could only have been marine]).

and refers in synonymy to Ray (1704) and (1724) (i.e. to Dillenius for whom Linnaeus had a great regard), to Plukenet (1696) quoting both figures, to Petiver (1695) and to Boccone[1] (1697); for localities he gives " *Anglia; Italia* "[1]. Linnaeus accepts the view that there is one species and bases his concept (as does Dillenius) on *H. tunbrigense* as he quite likely never saw *H. wilsonii;* there is in fact one sheet of *Trichomanes* [*Hymenophyllum*] *tunbrigense* in the Linnaean Herbarium in London, annotated by J. E. Smith " Ex Anglia " and presumably from Tunbridge Wells. In his own copy of Plukenet, Linnaeus has written in the margin of t.3 " 5, 6, [bracketed together] Adiantum " and in a later pen has crossed this out and written " Trichomanes tunbrigense ". Similarly this name is written against *Adiantum petraeum* . . . in Linnaeus' copy of the Stirpium Britannicarum 3rd ed.

Between the years 1785 and 1790 James Bolton of Halifax published a set of plates and text entitled *Filices Britannicae.* On page 58 he gives a description under *Trichomanes tunbrigense* of a plant which is more likely *H. wilsonii* [cf. " pinnae 2 or 3 lobed " and " seed-vessels, globular, size of a small mustard seed "]; his figure, a bad one, could be either species. Bolton adds to the confusion by adding the following comment " I suspect the *Trichomanes pyxidiferum* [=*T. speciosum* Willd., the Bristle-fern] of Bell Bank [near Bingley, Yorks.] to be a luxuriant variety of this plant; their figure, texture, colour and whole habit are the same, only differing in magnitude . . ." [in this he is incorrect for the Bell Bank plant collected by Dr. Richardson is in the Sloane Herb. (H.S.302f.66) and is *T. speciosum*]. Furthermore he writes in the Introduction (p. xii), " There is a variety of *Trichomanes tunbrigense* which grows in little caverns under moist rocks where the sun is excluded, and where the water, dripping from the points of the leaves, enlarges them greatly; in this state the plant has been taken notice of, and called *Trichomanes pyxidiferum* ". The concept at that time may well have been based on a luxuriant habitat form of *H. wilsonii.*

J. E. Smith was the first to divide the genus *Trichomanes* as conceived by Linnaeus and in 1793 published the genus *Hymenophyllum*[2], on the basis of the enclosed columella and bivalved involucre, listing (*Trichomanes*) *tunbrigense* L. as the first, now regarded as the type, species. The British Floras of the time, e.g. Withering, *Botanical Arrangement of British Plants* (1792), Hull, *British Flora* (1799) and J. E. Smith, *Flora Britanica* (1804) omit the true Bristle-fern and include the Bell Bank plant (v.s.) and other records of *T. pyxidiferum* L. as varieties of *H.* (or *T.*) *tunbrigense.* Smith went further in 1805 when he described the Bell Bank plant as a new species *Hymenophyllum alatum* in an attempt to show that *Trichomanes pyxidiferum* of many British authors was not the same as the American plant of that name (i.e. true *T. speciosum* Willd.). Sowerby's drawing of *H. allatum* J.E.Sm. in *English Botany* **20**:t.1417, whilst omitting the exserted columella, shows a typical narrowly campanulate indusium of a true *Trichomanes!*

[1] *Museo di piante rare della Sicilia, etc.* . . . 2:24 t.2., f.1 [a poor drawing of sterile *H. tunbrigense;* this is the first record from the Continent].
[2] In Mem.Acad.Roy.Sci.Turin 5:418, t.9, f.g.

Twenty-five years later, in 1830, W. J. Hooker cleared the matter up in his *British Flora:* he included *Trichomanes speciosum* (as *brevisetum*) in the British Isles and besides *Hymenophyllum tunbrigense* described a new species — *H. wilsonii*, as " abundant in the Highlands of Scotland and many parts of Ireland ", and named after Mr. W. Wilson, the bryologist, who " found them both growing at the Lakes of Killarny and distinguished them specifically ". Later in the *Synopsis Filicum* (1868) Hooker had second thoughts and wondered if *wilsonii* may be of subspecific rank This later opinion was formed after he had seen much more material of this species — complex from various parts of the world — material that appeared intermediate between *tunbrigense* and *wilsonii*. Hooker, by widening his concept of the species brought about nomenclatural problems as to the earliest name and whilst *H. unilaterale* Bory ex Willd. is common in the literature, *H. peltatum* (Poir.)Desv. the legitimate name (if regarded as a single species) is also in the Floras. Today, however, *H. wilsonii* Hook. is accepted as a separate species confined to N.W. Europe and as such the name is legitimate.

We have tried to show in this short paper that whilst the older botanists discerned two species of filmy fern on vegetative characters alone Linnaeus followed Dillenius and regarded them as one, basing his concept (luckily) on an English plant of *H. tunbrigense*. Confusion continued with *tunbrigense*, *wilsonii* and *Trichomanes speciosum* being taken as a cline in the one species-complex. Hooker eventually redescribed the original taxon as *H. wilsonii*, thinking later that the differences may only be infra-specific. Recently new criteria (such as cell-size, chromosome number and ecological behaviour) have removed the apparent similarity of much foreign material and emphasised the distinction in Britain so that specific rank may now be given to our species with some certainty. We should like to thank Dr. W. T. Stearn of the British Museum (Natural History) for much helpful discussion.

SHORT NOTES (cont.)

HYMENOPHYLLUM TRANSPLANTS IN KENT AND SUSSEX

As part of researches into the autecology of British *Hymenophylla* the following transplants were made Nov. 4, 1961: at Eridge Rocks, Sussex, two mats, (approx. 10 sq. cms. of *H. wilsonii* (from Tryfan Mnt., Caerns.) were planted in patches of *H. tunbrigense*, another on a bare rock-cleft wall and a fourth near the site of the *Dryopteris aemula*. At Hungershall Rocks, Kent, two similar mats one of *wilsonii* and one of *tunbrigense* (from Eridge Rocks) were planted a yard apart on a peaty ledge with a N. aspect. No *Hymenophyllum* has ever been recorded specifically from Hungershall Rocks, to my knowledge. It is planned to keep these experiments under complete control and the *wilsonii* will eventually be removed from the locality. I shall be pleased to hear of any observations on the gametophytes or young sporophytes of these two species.

GARETH B. EVANS

CYSTOPTERIS ALPINA AND C. DICKIEANA IN THE ROCK GARDEN

Cystopteris alpina and *C. dickieana* have both been growing for more than twenty years in the writer's garden in Surrey. They have been given the minimum attention: none at all for five years during the last war and it seems worthwhile to describe the rather unorthodox method of cultivation. The small garden in approximately 400 ft. above sea-level, on the sides of the Downs, sloping south and west; the soil consists almost entirely of disintegrated chalk. The ferns were planted in a small rockery of irregular form made of rough-hewn sandstone which is hard but retentive of moisture. Part of this rock-work faces north and forms a shady " cliff " about 15 inches high, the spaces between the horizontally laid stones being filled with garden soil. A good deal of moss forms on this cliff-face but does not damage the *Cystopteris* as these ferns have the alpine characteristic of dying down completely after a short period of growth in the summer. In the early spring whilst the fern is still below ground it is desirable to clear away the remains of fronds and to remove the moss. Grown in this way the ferns look much the same as they do in their native haunts; *C. dickieana* happily works its way along the horizontal crevices in the rock-work. It is constantly small in stature, averaging perhaps about 4 or 5 inches, the fronds tend to be broad and rather foliose and the pinnae slope down from back to front suggestive of the laths in a Venetian blind — this is a useful identification character in a living specimen not so evident in a pressed frond. A further distinctive character of *C. dickieana* as compared with *alpina* is the production of a few, and usually less vigorous, fronds in the late autumn. On the face of it it is difficult to see why *C. dickieana* should be considered a variety of the polymorphic *Cystopteris fragilis.*

P. GREENFIELD

BRITISH PTERIDOLOGICAL SOCIETY

FIELD MEETINGS FOR 1961

KEW GARDENS, Saturday, 29th April. This visit to the Fern Houses at Kew Gardens, arranged by our member Mr. H. J. Bruty who is in charge of the Houses, was attended by eleven members and one visitor. The ferns all belong to warmer climates and our President was able to impart much interesting information on the many plants which he sent home to Kew from Malaya, Borneo and elsewhere. Mr. Bruty was kept busy answering questions on the methods of growing these ferns, particularly in his propagating houses where we saw plants in all stages of growth from the prothallus onwards.

We have to thank Mr. Bruty for a most enjoyable day, and the opportunity given for getting to know some of our newer members, whom we were very glad to welcome.

SHAFTESBURY, DORSET, 9th - 11th June. The headquarters of this meeting was at the St. Edward Hotel, Shaftesbury where the party met on the Friday evening. The following morning the party of ten members and friends went under the direction of Mr. Peter F. Hunt to Asham Wood, an ancient ashwood on limestone. Here the ground flora over the large boulders that formed the sides of this wooded valley consisted of many *Phyllitis* plants (each of which were carefully examined — but in vain) *Asplenium trichomanes*, *Dryopteris borreri* and *Polystichum aculeatum* and the occasional plant of *Cystopteris fragilis*. After lunch in Nunney Castle the *Polystichum* hunt was continued at Railford Bottom and from there to Shepton Forest on the Old Red Sandstone. Here in the boggy lags around the plantations *Dryopteris lanceolatocristata* was found along with *dilatata* and *Athyrium filix-femina*.

Sunday was spent in the woods, mainly of birch, on the Greensands around Stourton. The usual ferns were noted and it was interesting to see the not too common *Equisetum telmateia* and the very uncommon *E. sylvatica* in King's Wood Warren.

EAST GRINSTEAD, Sunday, 16th July. Persistent rain could not discourage our party of six which met at East Grinstead Station and set off for a locality near Turners Hill where we hoped to find *Hymenophyllum tunbrigense* and *Dryopteris aemula*. We found neither, but had good hunting in wet woodland which produced *Dryopteris lanceolatocristata* in quantity. Working in an easterly direction towards Tunbridge Wells after lunch we hunted *Lycopodium inundatum* in vain, and we finished our day near Newbridge where our finds included *Thelypteris palustris*. In all eleven species were found.

VISIT TO MR. T. H. BOLTON, BIRDBROOK, ESSEX, Saturday, 12th August. This outing will long be remembered by the participating members as one of the most enjoyable ever held by the Society. Sixteen members and friends were entertained to lunch by Mr. Bolton and his family, and later

were let loose among his ferns. It was typical of our host's generosity that he had garden forks and plastic bags all ready, and ferns coveted by members, provided they were not the one and only specimen of their kind in the collection, were dug up and bagged. The number of ferns leaving Birdbrook that day had to be seen to be believed, but made little impression on the magnificent Bolton collection. After tea we went our several ways home and our thanks to Mr. and Mrs. Bolton and their family, though profuse, could not adequately express our appreciation of a happy day and their warm liberal hospitality.

THE ANNUAL EXCURSION, 23rd - 30th September. Snowdonia proved to be a popular choice for the Annual Excursion, which was attended by a record number of members. We were very pleased to have our President with us, together with Mrs. Holttum, who joined in all our expeditions. In addition, the London area was represented by J. A. Crabbe, P. Halligey, A. C. Jermy, R. M. Payne, R. S. W. Pollard, Mrs. Pollard, W. Wright and the Secretary. From the North came Miss A. Sleep, Messrs. F. Jackson, R. Kaye, N. Robinson and W. S. Webster. Later in the week we were joined by our Midland members, Mr. and Mrs. T. A. Dyer and L. Burnett. We were glad too, to welcome Mr. Proctor who is in England from Kingston, Jamaica to work on a fern flora of Jamaica, and who took this opportunity to have a look at our ferns. It was a great disappointment not to have with us Mr. P. Greenfield who for so many years has been the mainspring of the Excursions. It was a bitter disappointment for him, as at the last moment he had to cancel his plans because of serious illness in his family. We missed him badly.

Our headquarters was the Aberdunant Country Club, Prenteg, near Portmadoc in Caernarvonshire, and here we had an ideal centre for our purpose, in an old manor house set in extensive wooded grounds with glorious views of the mountains to the North. The half-mile entrance drive was up a dark ravine rich in ferns, including *Polystichum setiferum* and *Hymenophyllum tunbrigense*. Naturally, we commenced our hunting here on the Sunday, and recorded in all 12 species. Later in the day we wandered further afield along the Caernarvon road, and explored up the valley of the Afon Dwyfor which was not particularly rich in ferns, and only the more common species, 12 in number, were found.

Snowdonia is one of the richest areas in plant life in Britain, and it is satisfactory to know that this has been recognised and steps taken to preserve the region, which in 1951 became a huge National Park. Protection does not end here however, for within the Park, preserving its riches for posterity, two other powerful bodies are active, the National Trust which owns several properties, and — what concerns us more — the Nature Conservancy which selects and maintains areas of outstanding interest. There are several of these Nature Reserves in the Park, and one of the objects of our Excursion was to visit as many of them as possible. In this we were greatly helped by Dr. Brian Seddon from the Nature Conservancy Headquarters for Wales at

Bangor, and by Mr. Evan Roberts, the well-known naturalist and Warden of the Cwm Idwal Reserve, and their co-operation was very much appreciated.

We visited four of the Nature Reserves. The Coed Tremadoc Reserve is near Prenteg and we visited this on our first day. It is a precipitous area of dense oak woodland with ferns dominating the undergrowth on the wet rocky slopes. We recorded ten species, with *Polystichum setiferum* the common fern growing strongly in great abundance, very reminiscent of its extensive growth in the West Country. A very similar place is the Dolgarrog Reserve, with dense woodland clinging to a steep rocky hillside. We visited this on Thursday accompanied by Dr. Seddon, and again ferns were dominant in the undergrowth. The same ones were here, the large-growing common species and some of the smaller rock ferns, with the addition of *Thelypteris limbosperma*, but *P. setiferum* was not so abundant and occupied but one small area.

Of much more interest to us was the small Reserve of Cwm Glas Crafnant at the head of the Afon Crafnant valley, visited on the same day in the company of Dr. Seddon. This is a precipitous headland on the hillside facing north-east, closely covered with stunted trees. The high humidity and shade foster the development of a great variety of mosses, which demanded more than passing attention. Here too grows *Sedum telephium* and *S. forsterianum*, and many other flowering plants to which we could have devoted much time, and we had to remind ourselves that it was the ferns we had come to study. They too are there in variety, and in this small reserve, only an acre or two in extent, we recorded 15 species. Among them we noted a few plants of *Asplenium trichomanes*, *A. adiantum-nigrum*, *A. viride*, and *Cystopteris fragilis*. A fine colony of *Hymenophyllum wilsonii* was found on wet rock, and *P. setiferum* and *P. aculeatum* were both seen, but only in small numbers.

Our visit to Cwm Idwal Nature Reserve was a much more strenuous expedition which occupied a whole day — the Wednesday, and was led by the Warden of the Reserve, Mr. Evan Roberts, accompanied by Dr. Seddon and Mr. G. B. Evans from the University College of North Wales, Bangor, who is working on the filmy ferns. The going was hard and not all of us completed the course. Lunch was taken in pouring rain, sheltering as best we could under great boulders below the Devil's Kitchen, and trampling *H. wilsonii* underfoot. Afterwards only the more energetic members of the party continued upwards, and the others retired to hunt in the Cwm until the deteriorating weather with high wind and driving rain forced them to retreat. *Woodsia ilvensis* grows on rocks in this vicinity and this was a magnet to attract us upwards through any weather. Soaked through and cold we plodded on led by Mr. Roberts, and we got our reward. In some rock crevices grow a few insignificant plants of the rare fern, and about 15 minutes were spent photographing them in the most impossible conditions — cold lashing rain driven by the wind on the exposed hill-top. Then on once more to a higher top below which, in the steep stony screes, grows *Polystichum*

lonchitis. Again there was a division in our party, and only a few enthusiasts traversed the loose screes to see the holly fern. Some of us had already seen it a few days earlier on Snowdon, and by this time our chief desire was to get back to warmer and drier conditions. This was the only wet day we had during the whole week, and although it would have been pleasanter without it, still it did not detract from the enjoyment of the day. Not very many ferns were seen, and in addition to those already mentioned the most noteworthy is the Quillwort, *Isoetes echinospora*, found in the Lyn Idwal.

A day was spent on Snowdon. Walking from the Gorphwysfa Hotel, Pen-y-pass, we climbed by a track past the two lakes, Llyn Teyrn and Llyn Llydaw up to Glaslyn at the foot of the great precipice leading to the summit of the mountain. Hunting as we walked, the number of species mounted quickly, and we finished the day with a total of 20. Nowhere were ferns to be seen in great abundance, but the types of habitat are varied and each fosters a selection of suitable species. On the screes, *Cryptogramma crispa* flourishes happily, and in odd places grow the occasional *Dryopteris filix-mas*, *D. borreri*, *D. dilatata*, *Athyrium filix-femina*, *Polypodium vulgare*, and *Blechnum spicant*. The ruined buildings of the long disused copper mines make a happy home for *Asplenium trichomanes*, *A. ruta-muraria*, *A. viride*, *Ceterach officinarum* and *Phyllitis scolopendrium*, and up on the scree slopes below the precipice of Clogwyn-y-Garnedd we found *Cystopteris fragilis*, *Thelypteris phegopteris*, *T. limbosperma* and *D. abbreviata*. On the cliffs above grows *Woodsia alpina* and a few of us climbing in search of it, had the good fortune to find one plant on the rock face about ten feet above a ledge on which we were standing. Near here too we found the rare *Polystichum lonchitis*, and also *Hymenophyllum wilsonii*. Our twentieth find was *Isoetes echinospora*, growing in one of the lakes. Three club-mosses were also noted, *Lycopodium selago*, *L. clavatum*, and *L. alpinum*.

Again in pursuit of *Woodsias*, this time *W. ilvensis*, we spent a day on the rocky slopes of Moel Hebog above Cwm Meillionen near Beddgelert. The approach was through Forestry Commission plantations, and having missed the path, we had to struggle upwards through the dense growth of young conifers until we emerged on the open hillside. Hidden among the trees we passed a low cliff, its wet surface covered with a luxuriant growth of *H. tunbrigense*. In the lower and more open part of the wood a colony of *Thelypteris phegopteris* spread itself happily through the sedges and grass on the wet hillside. Climbing and scrambling on the cliffs, we were again fortunate in finding our *Woodsia*. On the sheer wall of a perpendicular chimney, we counted in all nine plants of *W. ilvensis*, and with some difficulty were able to take close-up photographs of one of them. Other ferns on the rocks were *A. trichomanes*, *A. viride*, *A. ruta-muraria* and *C. fragilis*, while on the screes some *Cryptogramma crispa* was seen. The club mosses *L. selago*, *L. clavatum* and *L. alpinum* were abundant on the hillside, particularly *L. alpinum* which was present in great quantity.

We found so much to occupy us in the Snowdon area that we were able to turn to the south for one day only. Two very rare ferns were our objectives, *Trichomanes speciosum* which has been found on the south side of the Afon Dwyryd Estuary, and the rare hybrid *Asplenium alternifolium* which grows on the hills north of Llanelltyd. The habitats were known to a few of us and we were successful in finding two plants of the *Asplenium*, one growing in a rock crevice and the other on scree. The latter was ideally positioned for some successful photography. Both parents of the hybrid, *A. septentrionale* and *A. trichomanes* were growing in numbers nearby. The Killarney Fern was not so obliging unfortunately, and after a wet fruitless hunt up the course of a mountain torrent exploring every nook and cranny and behind waterfalls, we reluctantly gave up the search. In spite of this disappointment, we were very satisfied with the day's hunting. In addition to *A. alternifolium*, we found *Dryopteris aemula* near a large waterfall, growing vigorously on a narrow ledge above the waters, and presenting a very tricky problem for our photographers. Here too, the two *Hymenophyllums* were abundant on the rocks, as was *A. obovatum* on stone walls by the roadside on our way up the coast from Barmouth. These ferns with *D. abbreviata* and others, totalling 21 species, made the day outstanding.

At the end of the week we were very conscious of all we had *not* done, and in a vain attempt to put some of this right, Saturday developed into a scramble to visit a multitude of places. Our first stop was to see *Asplenium marinum* on the sea-cliffs near Criccieth. Thereafter each car went its own way — two travelled as far as Anglesey while the other two contented themselves with exploring odd corners near Prenteg. Rushing torrents cascading down the steep hillsides in deep ravines are a feature of this countryside and ferns revel in the humid conditions created by the drifting spray. On the rocks high above one very deep and spectacular ravine, *A. septentrionale* was plentiful in the crevices. Today too, after searching in vain in all likely places during the week, we were able to add *D. lanceolato-cristata* to our list.

This excursion was outstanding — from the number of members attending which compares with the attendances during the early days of the Society when the fern cult was in its heyday, and from the number of species found, 34 in all, which is a pretty impressive figure for one small corner of the country when we consider that there are only about 50 fern species in Britain. Many of our rare ferns were seen for the first time by most of us, and it was very satisfying to see the two *Woodsias*, *P. lonchitis*, and *A. alternifolium*. We should include *A. septentrionale* among our rare finds, but we saw so much of it that we ceased to think of it as rare. Dr. Seddon introduced us to one large colony numbering hundreds of large plants growing in the dry-stone wall by a roadside in the Conway valley. This road is scheduled for widening in the near future, and the wall is to be pulled down. It is a tragedy to think that what must be one of the finest colonies—if not *the* finest—of this fern in Britain is going to be destroyed. The Nature Conservancy at Bangor

is very conscious of this, and it is planned to move the ferns before the wall is pulled down, and establish them on other walls in the vicinity. We appreciate very much the thought and care which is being given to their preservation although we cannot help feeling pessimistic about the success if the operation. It deserves to succeed and we sincerely hope it will. Along the same road, the sight of a fine colony of *Ceterach officinarum* covering an old high wall gave us great pleasure, and many fine plants were collected without making any impression on the numbers there.

Although Snowdonia can offer a wealth of fern species, variation is absent. Those of us who are variety hunters kept our eyes open and two finds only were made, one a *C. officinarum* with crenate fronds, and the other a promising small plant of *A. filix-femina* growing on high rocks. Although small it was not a young plant and consisted of two crowns with fronds of a very unusual character which however is difficult to describe as they were so small and past their best. Mr. Jackson and the Secretary each have a crown and we look forward to seeing what the fern will do next year.

A list of the species recorded is appended, and the numbers against each indicate the localities where found as shown in the list of place names also appended. Vice-county numbers and grid-references are included.

Isoetes echinospora Durieu — 11, 13.
Hymenophyllum tunbrigense (L.) Sm. — 1, 12, 19.
H. wilsonii Hook.— 11, 13, 17, 19.
Pteridium aquilinum (L.) Kuhn — 1, 3, 6, 10, 12, 15, 16, 17, 18, 19, 20, 22.
Cryptogramma crispa (L.) R.Br.ex Hook.— 11, 12, 13, 16, 20.
Blechnum spicant (L.) Roth — 1, 3, 6, 9, 10, 11, 12, 13, 15, 16, 19, 20.
Phyllitis scolopendrium (L.) Newm. — 7, 11, 18, 22.
Asplenium adiantum-nigrum L. — 1, 3, 6, 7, 10, 15, 17, 18, 20, 22.
A. obovatum Viv. — 1, 4, 8, 21.
A. marinum L. — 8.
A. trichomanes L. — 1, 2, 3, 6, 7, 10, 11, 12, 13, 15, 16, 17, 18, 20.
A. viride Huds. — 11, 12, 13, 17.
A. ruta-muraria L. — 2, 10, 11, 12, 15, 20.
A. septentrionale (L.) Hoffm. — 5, 14, 20.
A. alternifolium Wulf. — 20.
Ceterach officinarum DC. — 2, 11, 15.
Athyrium filix-femina (L.) Roth — 1, 3, 6, 7, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20.
Cystopteris fragilis (L.) Bernh. — 11, 12, 13, 17.
Woodsia ilvensis (L.) R.Br. — 12, 13.
W. alpina (Bolton) Gray — 11.
Dryopteris filix-mas (L.) Schott — 1, 3, 7, 9, 10, 11, 12, 15, 17, 18, 19, 20, 22.
D. borreri Newm. — 1, 3, 6, 7, 9, 10, 11, 12, 15, 16, 17, 18, 19, 20.
D. abbreviata (DC.) Newm. — 6, 11, 15, 20.
D. lanceolatocristata (Hoffm.) Alston — 9.
D. dilatata (Hoffm.) A. Gray — 1, 3, 6, 7, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20.
D. aemula (Ait) Kuntze — 19.
Polystichum setiferum (Forsk.) Woynar — 1, 7, 17, 18, 22.
P. aculeatum (L.) Roth — 13, 17.
P. lonchitis (L.) Roth — 11, 13.
Thelypteris limbosperma (All.) H. P. Fuchs — 1, 3, 6, 9, 10, 11, 12, 13, 16, 17, 18, 19.
T. phegopteris (L.) Slosson — 10, 11, 12, 17, 19.
T. dryopteris (L.) Slosson — 13, 20.
Polypodium vulgare L. — 1, 3, 6, 7, 9, 10, 12, 15, 16, 17, 18, 19, 20, 22.
P. interjectum Shivas — 1, 11, 22.

1. Prenteg — V.C.49, 23/5841.
2. Portmadoc — V.C.49, 23/5738.
3. Cerrig-y-rhwydwr — V.C.49, 23/5943.
4. Garregelldrem — V.C.48, 23/6143.
5. Afon Maesgwm, near Croesor — V.C.48, 23/6344.
6. Aberglaslyn — V.C.49, 23/5946.
7. Coed Tremadoc Nature Reserve — V.C.49, 23/5640.
8. Black Rock — V.C.49, 23/5237.
9. Wern — V.C.49, 23/5439.
10. Llanfihangel-y-pennant — V.C.49, 23/5244.
11. Snowdon — V.C.49, 23/6154.
12. Moel Hebog — V.C.49, 23/5647.
13. Cwm Idwal Nature Reserve — V.C.49, 23/6459.
14. Near Llanrwst — V.C.49, 23/7961.
15. Trefriw — V.C.49, 23/7763.
16. Llyn Crafnant — V.C.49, 23/7561.
17. Cwm Glas Nature Reserve, Crafnant — V.C.49, 23/7360.
18. Dolgarrog Nature Reserve — V.C.49, 23/7766.
19. Ganllwyd — V.C.48, 23/7224.
20. Near Llanelltyd — V.C.48, 23/7221.
21. Llanfair — V.C.48, 23/5729.
22. Near Penmynydd, Anglesey — V.C.52, 23/5174.

THE SECRETARY'S AND TREASURER'S REPORT

Progress has been maintained during the past year. The second issue of the new Gazette has upheld the standard set by Part 1 and has attracted wide attention both at home and abroad. It is satisfactory to know that our overseas subscribers are increasing in number and that we have something of interest to offer them. At home our meetings have increased — our widely scattered membership does not allow many to attend each meeting, but at some we have had a dozen and more members and this can be considered very satisfactory. Meetings in the North however have not been so well supported. We would like to see these a strong feature in our annual programme. The Society was born in the North, we have a very large membership there and it is fitting that we should be active in this area where so much field work is awaiting our attention.

The Annual General Meeting was held on 27th September, during the Annual Excursion, at Prenteg near Portmadoc in North Wales. Professor R. E. Holttum was again elected President and all the other Officers were re-elected. The resignation of Mr. H. Wainwright from the Committee left eight members who were re-elected and two new members, Messrs. R. M. Payne and R. S. W. Pollard were elected to bring the number up to full strength.

The new Constitution of the Society was approved and appears in this issue.

Our satisfactory progress unfortunately does not extend to our financial affairs — in fact progress has been at the expense of finance. The cost of the Gazette was again heavy but was justified to ensure a good production which

would consolidate the favourable impression created by the previous issue. This is long term policy which we are confident will eventually pay dividends, but in the meantime we are faced with the fact that an annual subscription of 10s. which was considered necessary as far back as 1920 is inadequate for our needs today, and we have had to increase the amount to 17s. 6d. The appended Financial Statement shows the position.

We hope that all our members will take a realistic view of the increase in the subscription rate and continue to give us their loyal support, and this leads me to my usual final remarks — *many subscriptions still remaining unpaid do not help our bank balance, and I would urgently request that these be forwarded to me at your earliest convenience — or earlier!*

Financial Statement at 30th June, 1961

1960 June 30th		£	s.	d.	£	s.	d.
	To Balance				52	3	8
	Subscriptions ...				48	10	0
	Donations				7	0	0
	Sale of Census Lists					15	0
	Advertisements ...				1	10	0
	Sundry Debtors:						
	Advert	1	10	0			
	Sale of Gazettes to Leyden University	19	18	0			
					21	8	0
					£131	6	8

		£	s.	d.	£	s.	d.
	To Balance				£10	5	5
	Cost of Census List ...				20	7	11
	Subscriptions to:						
	R.H.S.	2	2	0			
	Council for Nature ...	1	0	0			
					3	2	0
	Postages and Incidental Expenses:						
	Secretary	7	1	11			
	Editor	1	17	11			
					8	19	10
	Sundry Creditors:						
	Due to the Courier for Gazette, Vol. 9 No. 2	79	15	0			
	Index to Vol. 8 ...	8	16	6			
					88	11	6
	Balance				10	5	5
					£131	6	8

1961 June 30th

(signed) J. W. Dyce, Hon. Treasurer
(signed) Peter Temple, Hon. Auditor

Constitution of the British Pteridological Society

as adopted at the A.G.M., 27th September, 1961

1 NAME The Society shall be called " The British Pteridological Society."

2 OBJECTS The objects of the Society are to promote and encourage the study and conservation of Ferns and other Pteridophytes and to do all such acts as shall further the active and corporate life of the Society and may lawfully be done by a body established only for purposes recognized by the law as charitable.

3 MANAGEMENT The Officers of the Society shall consist of a President, up to six Vice-Presidents, a Secretary, Treasurer, and Editor of Publications.

The Management of the Society shall be in the hands of a Committee consisting of not more than ten elected members with the addition of the Officers. Three members shall constitute a quorum. The Committee shall have the power to co-opt additional members for special purposes.

The Officers and members of the Committee shall be elected at an Annual General Meeting, and shall remain in office until the next Annual General Meeting when they shall retire but be eligible for re-election. In the event of a vacancy occurring during the year, such vacancy may be filled by the Committee.

A resolution in writing signed and agreed to by all the members of the Committee for the time being in the United Kingdom shall be as valid and effectual as if it had been passed at a meeting of the Committee duly called and held, and may consist of several documents in the like form each signed by one or more members of the Committee.

4 MEETINGS The Annual General Meeting of the Society shall be held at such time and place as the Committee may decide for the purpose of passing accounts, electing members, officers and the Committee and transacting the general business of the Society. General and Field Meetings shall be held at the discretion of the Committee.

An Extra-ordinary General Meeting shall be called by the Secretary within thirty days of receiving a request in writing of the Committee or of not less than twenty members stating the purpose for which such meeting is required.

At least 21 days notice of any general meeting shall be given to all members.

5 ORDINARY MEMBERSHIP AND SUBSCRIPTIONS A candidate for membership must be proposed and seconded by members of the Society in writing and may be elected at a Committee Meeting or at a General Meeting.

The annual subscription payable by members shall be payable in advance, and due on the 1st of July in each year, or on the election of the member. In the event of the election of a member after 31st March his subscription shall cover the succeeding year from 1st July.

The rates of subscription shall be fixed by a General Meeting from time to time.

6 HONORARY MEMBERSHIP The Committee may elect any person or persons to Honorary Membership of the Society. Honorary members shall be entitled to all the privileges of membership, but shall not be liable for payment of any subscription.

7 REMOVAL FROM MEMBERSHIP Any member failing to pay his subscription within six calendar months of its becoming due shall be liable to have his name removed from the List of Members of the Society and upon such removal shall cease to be a member but shall be liable for his subscription for the current year and for any previous years.

Any member whose conduct in the opinion of the Committee is prejudicial to the interests of the Society may be removed from membership by a two-thirds majority vote of those present at a meeting of the Committee on the Agenda paper of which the words " Removal of a Member " shall have appeared; provided no member may be so removed unless due notice has been sent to the member of the intention of the Committee to proceed under this Rule and of the nature of the charges made and an opportunity has been afforded of answering such charges to the satisfaction of the Committee. A member so removed shall forfeit any claim upon the Society.

8 AWARDS The Committee may make awards in respect of plants of outstanding scientific or horticultural interest.

9 ALTERATIONS TO RULES This Constitution may be altered as follows:

Any proposal for alteration or addition to this Constitution shall be in writing, and shall be signed by two members, and be deposited with the Secretary not less than thirty days before the Annual General Meeting. Such alteration or addition shall be included in the Agenda of that meeting and circulated to all members and shall not be carried unless the votes of two-thirds of the members present at the meeting are cast in its favour.

10 DISSOLUTION The Society may be dissolved by a vote of at least three-quarters majority of those present and voting at an Extra-ordinary General Meeting called for that purpose and if an effective resolution for dissolution is passed the surplus funds and property of the Society shall be disposed of to an agreed charitable organisation of similar interest or in default to a similar charitable body decided by the Council for Nature.

11 NOTICES The accidental omission to give notice of a meeting to, or the non-receipt of notice of a meeting by, any member shall not invalidate any proceedings or resolutions at any meeting of the Society or any Committee thereof.

OBITUARY

JOHN COCHRAN

It is with great regret that we have heard of the death on 29th November, 1961, at the age of 94, of our old member John Cochran of Kilmarnock. He was a joiner by trade, but was devoted to his garden and his plants. He specialised in chrysanthemums and bulbs for which he won many awards at Flower Shows, but his great interest was in his ferns of which he had a large

collection. He joined our Society in 1928, and right up to the end of his long life continued to be one of our staunchest supporters. It was a great sorrow for him when at the age of 89, he felt he was unable to give his ferns proper attention, and had to part with them. The collection was gifted to his native town of Kilmarnock, and is still being well cared for.

The evening of his life was peaceful and happy in the care of his son and daughter-in-law, to whom we extend our deepest sympathy.

NOTICE TO MEMBERS

The Society now subscribes to the AMERICAN FERN SOCIETY and receive their quarterly journal. This is available for circulation among members and any interested in joining this reading circle please contact Miss M. I. Tetley, High Gable, Grange-over-Sands, Lancs., who has kindly undertaken to look after this. For the time being the AMERICAN FERN JOURNAL may be kept for up to two weeks only, please, and returned to Miss Tetley. Applications *must* therefore be accompanied by a *stamped* (4½d.) *addressed* envelope, 9in. by 6in.

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THE

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THE
BRITISH FERN GAZETTE

VOL. 9 1963 PART 4

VARIATION IN *POLYSTICHUM* IN THE BRITISH ISLES

J. W. DYCE

Loughton, Essex

About the middle of the nineteenth century ferns were becoming popular plants and it must have been about this time that interest in variation was fully aroused; up till then little reference to varieties appeared in the fern books beginning to pour out; soon after, we find E. J. Lowe, T. Moore and others listing varieties more fully and the many fine ones of *Polystichum setiferum* must have done a lot to awaken an interest which became almost hysterical enthusiasm. From 1850 a succession of enthusiasts hunted, recorded and grew varieties; E. F. Fox was one of the first, later collaborating with Colonel A. M. Jones in the breeding of many fine varieties, notably plumose divisilobes which mark the zenith of development in this form of *P. setiferum;* G. B. Wollaston followed and we find his name associated with numerous plants of quality, his *proliferum* being the forerunner of many fine acutilobes, multilobes and divisilobes; C. Elworthy and the Rev. C. Padley were active in the field making numerous additions to the list and others were found by Moly and Wills whose names are coupled with *divisilobum* and *pulcherrimum.*

The choicest plants were grown and passed on in the magnificent collections of a select cavalcade of collectors; the last of these was W. B. Cranfield who made seemingly adequate precautions in his will for their safety for posterity; at his death these plans did not work out as he intended and most of the cream of his collection was irretrievably lost. Fortunately, among our meagre legacy made up of the wreckage from Cranfield and of gems still existing in private and nursery collections, sufficient fine varieties remain to give pleasure to presentday growers.

The classification and nomenclature of fern varieties has been much bedevilled. Unfortunately many of the early enthusiasts seemed to collect everything abnormal and to name it all; *deficiens*, *depauperatum* and *irregulare*, so freely depicted in literature and nursery catalogues, were veritable monstrosities fitted only for the rubbish heap and these, together with many

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minor variations, undoubtedly did a great disservice to the cult by offending many people and by creating a most elaborate confusion of names; today such varieties are found in the wild quite frequently but are hardly ever collected for cultivation.

This endeavour to clear the confusion of varieties of our three species of *Polystichum* has not been dressed to conform to the *International code of nomenclature for cultivated plants;* it is felt that to have done so would have rendered many of the names unnecessarily unfamiliar in the British Isles, the epicentre of cultivation of fern varieties.

1. **Polystichum lonchitis,** the Hollyfern, is a rare alpine found on mountains in northwest and central areas of Scotland, the north of England, Snowdonia and the west of Ireland. The pinnate fronds are narrow and rigid, up to 12 inches and sometimes more in length and the pinnae are close-set and very spinose. It is very difficult to cultivate away from its natural habitats.

Two types of variation are recorded, a crested and a dense imbricate; it is very unlikely that any now exist in cultivation.

2. **Polystichum aculeatum,** the Hard Shieldfern, is widely but rather sparingly distributed, nowhere to be found in great abundance and perhaps commonest in Scotland and the north of England. It grows in woodlands, hedgerows and, particularly in the north, in rocky ravines. The bipinnate fronds are up to 3 feet in length, leathery in texture, with smooth shiny dark-green unstalked pinnules; unipinnate juvenile fronds tend to resemble the Hollyfern. It grows freely and happily in cultivation with little attention.

P. aculeatum has given few varieties and, with one exception, none of these seems to have survived; the outstanding exception, *pulcherrimum* and its progeny, includes some of the finest ferns we possess.

(a) *Pulcherrimum*

P. aculeatum pulcherrimum Bevis (Fig. 7). This unique and remarkable wild find by J. Bevis in a Somerset hedgerow in 1876 was given to Dr Wills and is one of the most beautiful of British ferns; it is vigorous and graceful and is described by Druery as " with long attenuate silken divisions delicately imbricate at frond tips and almost always barren "; it is evergreen, hardy and strong-growing in the border, needs a minimum of attention, propagates freely from its offsets and altogether is one of the finest and easiest of ferns to grow. On rare occasions a very few spores have been found and the results from them have been startling:

P. aculeatum pulcherrimum Druery (Fig. 6) (progeny of ' Bevis '). An improved form of the parent and equally hardy, strong and easy growing.

P. aculeatum gracillimum (Fig. 5) (progeny of ' Bevis '). A most remarkable series of plants, none quite alike and a complete departure from all

Figs. 1 - 7. Pinnae from the middle sector of the frond of some notable *Polystichum* varieties. 1 *P. setiferum acutilobum*, 2 *P. s. divisilobum longipinnatum* Carbonell, 3 *P. s. pulcherrimum* ' Moly's Green ', 4 *P. s. cristatum*, 5 *P. aculeatum gracillimum*, 6 *P. a. pulcherrimum* Druery, 7 *P. a. pulcherrimum* Bevis.

the usual types of variation. Again, Druery's description cannot be bettered —" several are of wonderful delicacy of cutting, the parental half-inch pinnules being extended sometimes to nearly 3 inches and of almost hairlike tenuity with splayed tassel-like terminals, imparting by their weight a peculiarly beautiful pendulous character to the fronds "; such plants usually need the protection of a glasshouse but some of them, not so finely developed, retain the parental hardiness and can be grown outdoors in sheltered positions.

Two plants of this variety exhibited by Druery received First-class Certificates from the Royal Horticultural Society.

P. aculeatum plumosum Green (progeny of ' Bevis '). This plant appeared in C. B. Green's batch of seedlings. It is a distinct and plumose plant of great beauty with finely-cut pinnules, and fronds about 18 inches long. The parental robustness has been inherited in full, making it an easy outdoor plant. It obtained an Award of Merit from the Royal Horticultural Society.

(b) *Plumosum*

Lowe records plumose and foliose varieties, but it is doubtful whether they still exist.

(c) *Densum*

Dense and imbricate varieties were recorded by Druery and Lowe but do not appear to be still in existence.

(d) *Acutilobum*

A few finds with acutely lobed pinnules, and proliferous like the *setiferum* acutilobes, have been recorded; one at least is still grown and can be purchased.

(e) *Cristatum*

This section includes all forms with frond apices and/or pinnae divided.

Cresting is the commonest variation in ferns and most of the few recorded varieties of *P. aculeatum* come under this heading; it is doubtful whether many still exist. *P. aculeatum grandiceps* Jones is still listed; it is very distinct, with large narrow erect fronds and branched terminal crests.

3. **Polystichum setiferum,** the Soft Shieldfern, is common in the south and southwest of England, South Wales and Ireland. It needs more warmth, shelter and drier conditions and these it finds in Devon, Dorset and Somerset, its chief centre in England where it grows abundantly and almost exclusively in sheltered lanes and hedgerows, being often the dominant plant. It becomes infrequent towards the east and north and in Scotland, apart from a few places in the west, is practically non-existent. The normal form of this fern is not so strong-growing as *aculeatum* and the fronds are rarely over 2 feet in length, 18 inches being a good average; an exception is a very common variation with tripinnate and sub-tripinnate fronds which is always very

conspicuous by its upright vigorous growth, up to 4 feet and more. The habit of the plant is spreading with more or less arched and drooping fronds which are soft and paler green, in marked contrast to the dark hard glossiness of *aculeatum*. The pinnules are spinose and somewhat crescent-shaped, broad at the base with a distinct slender stalk. Except in very sheltered conditions the fronds are not so persistent and die down much more quickly than those of the other two species. The normal form of *setiferum* makes an acceptable garden plant and is found in gardens throughout the country. Except in sun-baked positions, it is an easy plant to grow and its graceful soft green fronds will adorn shady corners and borders with a minimum of attention. An annual mulch of rotted leaves, a dusting of bonemeal very occasionally and, particularly in the south, some water during hot and dry spells will keep this fern happy and in a flourishing condition for many years.

The Soft Shieldfern is extremely variable; in any colony of the fern there is a wide range of minor variation in shape and habit; more extreme variation produces a vast number of forms. Lowe in *British ferns and where found* (1890) published a table of divisions, groups and sections covering 366 named varieties; the British Pteridological Society's selected list in Druery, *The book of British ferns* (1902) reduced the number to 173; today, after minor variations and undesirable monstrous forms are removed from the survivors, we are left with a greatly reduced list which, by still using Lowe's classification, appears as follows:

VARIATION IN *POLYSTICHUM SETIFERUM*

DIVISION A CHANGE IN FROND SHAPE

Group 1 **Cristatum**

(a) *capitatum* (crested apex)
(b) *cristatum* (crested apex and/or pinnae)
(c) *percristatum* (crested apex, pinnae and pinnules)

Group 2 **All other changes in frond shape**

(a) *brachiatum* (rhachis branching into three near the base)
(b) *deltoideum* (fronds triangular)
(c) *angustatum* (fronds narrowed)
(d) *cruciatum* (pinnae or pinnules twin-branched)
(e) *congestum* (pinnae dense and/or overlapping)

DIVISION B CHANGE IN PINNULE SHAPE

Group 1 **Plumosum**

(a) *plumosum* (increased development, thin texture, fructification scanty or absent)
(b) *foliosum* (sub-plumose, texture and fructification normal)
(c) *pulcherrimum* (lower pinnules, and sometimes upper, sickle-shaped, deeply incised and drawn out into thread-like processes. Fructification generally aposporous. Character more or less intermittent)

Group 2 **Divisum**

(a) *acutilobum* (tripinnate pinnules, all divisions acutely lobed, upper and lower pinnules of approximately equal length)

(b) *divisilobum* (tripinnate pinnules, all divisions acutely lobed, lower pinnules distinctly longer than upper ones, divisions more highly developed, approaching sub-quadripinnate or even quadripinnate)

(c) *decompositum* (subdivision on normal lines)

Group 3 **All other pinnule changes**

(a) *lineare* (pinnules narrow, acutely lobed and undivided).
(b) *rotundatum* (pinnules broad or rounded).
(c) *crispatum* (pinnules crisped)
(d) *setosum* (pinnules spiny)

DIVISION A CHANGE IN FROND SHAPE

Group 1 **Cristatum**

As already stated, cresting is the commonest distinctive type of variation in ferns, and *P. setiferum* has contributed in full measure a multiplicity of named forms which can all be gathered under this one heading; these are: *acrocladon* (with branching end), *capitatum* (having a head), *coronatum* (crowned), *corymbiferum* (bearing a cluster or corymb), *cristulatum* (having small crests), *grandiceps* (with a large head), *multifidum* (very much split), *percristatum* (crested all through), *polydactylum* (many-fingered), *ramosum* (branched), *ramo-cristatum* (crested and branched), *ramulosissimum* (having many small heads); this does not exhaust the list but they all mean more or less the same thing and can be sorted into three sections under the group heading.

Cresting, considered generally, does not enhance the beauty of *P. setiferum* and cannot be regarded as very desirable except for the collector interested in diversity of form. *Capitatum* in all its shapes is clumsy and top heavy and the names given to its variations (*acrocladon*, *coronatum*, *corymbiferum*, *grandiceps*, *multifidum*, etc.) are hardly less so. *Cristatum* (Fig. 4) can be more acceptable if the cresting is small and neat, but even then one has the feeling that the pinnae are overloaded and lacking in the grace of the normal form. *Percristatum* is a stage further with minute cresting at the tips of the pinnules and this does add something which helps to soften the general effect. On the whole, this group is more interesting than beautiful and most of the many named varieties seem to have sunk into oblivion. There has been very little mention of them in fern literature for many years. A few are still listed in fern catalogues and some possibly linger on unrecognised in fern borders known only as crested polystichums.

In the wild these crested forms still turn up occasionally and they seem to be one of the few surviving kinds of wild variation in *P. setiferum*. Intensive hunting by members of the Society in the West Country since the war has produced very few noteworthy finds, but these include three examples

of *cristatum* and one *percristatum*, all found by myself, two of them during the autumn of 1962.

Lowe (1890) contains 71 ferns which can be included in this group; they are reduced to about 24 in Druery (1902); today's catalogues contain only a few:

P. setiferum cristatum gracile Moly, a *percristatum* with dark green erect crested fronds, small crests on the pinnae, and the pinnules regularly fanned at the tips. My *percristatum* found last year is very similar.

P. s. cuneatum cristatum, fronds erect with terminal crests and wide wedge-shaped pinnules.

P. s. ramo-cristatum, dwarf dark-green broad-pinnuled form, repeatedly branched.

P. s. Thompsoniae Lowe seedling. fronds terminating in compactly branched heads.

Group 2 All other changes in frond shape

The five types of variation included in this group cover all other changes likely to be found. In *brachiatum* the branching of the fronds does nothing to enhance their appearance and only destroys their grace; its chief value is curiosity. *Deltoideum* and *angustatum* are more acceptable, particularly if accompanied by some pinnule change. Under *angustatum* can be placed the variety *revolvens* in which the pinnae are curved so as to give the fronds a narrow tubular shape; a good form can be very attractive. In *cruciatum* the pinnae are doubled and grow out from the rhachis at wide angles from each other, one upwards and one downwards; the overlapping with the other doubled pinnae gives a criss-cross effect up both sides of the rhachis and a good example of this variation is most effective. In *congestum* the axes are shortened with the result that the normal sized pinnae and pinnules are very close together and imbricate; provided it is regular *and constant*, this variation is well-worth growing but more often it is temporary, induced by adverse conditions, and such plants removed to the comfortable conditions of garden life flourish and become normal.

The sections in this group at one time contained a large number of named varieties, but most of them were worthless, being irregular, inconstant or near-normal. It is not surprising that very few remain. The first three sections seem to have disappeared from cultivation. *Deltoideum* and *angustatum* can still be noted in the wild, but are regarded as within the normal range of variation and are left in peace. *Revolvens* is probably still grown in some gardens, but does not seem to be obtainable commercially. *Cruciatum* and *congestum* can both be purchased, the former in a few forms, the most noteworthy being:

P. s. Wakeleyanum Moore, a narrow cruciate variety with crested apex. Found in South Devon in 1860.

DIVISION B CHANGE IN PINNULE SHAPE

Group 1 Plumosum

Division B contains the cream of the *setiferum* varieties and, probably because their great beauty has ensured a more widespread distribution, we find that a number of the old named forms still survive and form the bulk of *Polystichum* collections today. In Group 1 there have been many notable and remarkable plants but most of them have been lost. In the *plumosum* section itself I can find no record that the following continue to exist:

P. s. plumosum Elworthy, found in Somerset by Elworthy and stated to be very beautiful and distinct.

P. s. plumosum Patey, found in Dorset, with thin papery finely-cut fronds.

P. s. plumosum Wollaston, found in Devon, robust and fertile.

P. s. plumosum grande Fox
P. s. p. perfectum Birkenhead
P. s. p. splendens Col. Jones
} All raised, very robust and splendid plants.

P. s. plumosissimum Birkenhead, finely divided and, under extremely favourable conditions, Druery says "all the ultimate divisions extend into long tongue-like tails, piling up a moss-like growth upon the frond. A type of apospory; unique."

Some of these ferns were strong growers and it is possible they still survive unrecognised. However, we *do* still have with us:

P. s. plumosum grande Moly. This tall strong-growing barren variety is in my collection and produces annually, without fail, large heavy tripinnate fronds over four feet long and wide in proportion; the close-set, overlapping pinnae are like small fronds, with pinnules over one inch long, each resembling a small pinna with central rhachis and stalked pinnulets. It is truly a magnificent plant but the fronds are so dense and massive that, unless given some support, they are quickly broken at the base and complete the season lying on the ground. It is an easy fern to grow and the fronds remain fresh and green well into the following spring.

The next section, *foliosum*, is described as sub-plumose but in all other respects normal. This type of variation is met with frequently in the wild but is very seldom striking enough to induce the finder to collect it. Lowe lists many named forms but today only one seems to be in nursery catalogues; it is called *foliosum* and described as having broad erect fronds with very deep-cut pinnules. I think it is probable that the named examples of *foliosum* depended chiefly on other characters for their differences and the foliose character as such showed little if any variation. It would follow from this that in the strict sense there *is* only one *foliosum*.

The pulcherrimums were an ephemeral race and throughout the history of fern hunting it has been the ambition of all hunters to find one of these varieties in which F. W. Stansfield (*Gazette* **1**:275) says " the species rises to its highest flight of genius, at all events so far as wild varieties are concerned." They were too good to last and those that did last found the strain too much; most of them reverted to normal *setiferum* permanently, while some would throw up a frond in character occasionally, but more often only a few pinnae. In all, only sixteen examples of *pulcherrimum* were found in the sixties and seventies of last century, nine of them by Moly! None have ever been found since, although they have been hunted assiduously up to the present day. Their inconstant character probably has something to do with this, for it is possible that plants passed by as normals during the hunt may in other years, or even other seasons produce fronds exhibiting the *pulcherrimum* characteristics. These are so distinctive that they couldn't be missed. The peculiar development of the pinnules gives an extremely graceful and feathery appearance to the fronds which, in addition, are aposporous and the pinnule tips and abortive sori can under moist conditions develop prothalloid growths, producing young plants when layered. Only one *pulcherrimum* has survived:

P. s. pulcherrimum ' Moly's Green ' (Fig. 3). This is one of Moly's wild finds which, unlike all the others, is a vigorous grower; it develops, however, a multiplicity of crowns which, if allowed to remain, reduce the size of the plant and effectively prevent it from showing its true character. In common with the others it is intermittent and only a well-grown plant kept to a single crown is likely to be persuaded to show the *pulcherrimum* character, something well worth striving for. Although I have grown this fern for 10 years, I have not yet been fortunate enough to coax it into exhibiting its full glory, but that is probably because my fern borders are too exposed and get too dry in summer and I am always too busy to give the individual attention required by such plants. Given a good deep root-run in shaded conditions and all offsets removed as soon as seen, it should not be too difficult to succeed with 'Moly's Green'.

Group 2 **Divisum**

This group embraces most *Polystichum* varieties grown today; in the wild, the *decompositum* section is commonly found as tall vigorous plants with large tripinnate and subtripinnate fronds. Subdivision is on normal lines but, since the normal form of *setiferum* is a handsome and acceptable garden plant, so even more is the wild *decompositum*. It is only the ease with which they can be found and the vision of the finer forms of gentle blood beyond which blinds us to their beauty and leads us to dismiss them casually. Some outstanding ones have been found and named, as have been many which were not particularly outstanding. None of them seem to have

survived, but it must not be overlooked that *decompositum* is the link between the normal and the more elaborate and desirable forms; it should not be dismissed lightly. The best known was *P. s. decompositum splendens* Moly, said to be only occasionally fertile and bulbiferous. The Jones Nature Print shows this to be a very good tripinnate form but with nothing about it to indicate any latent possibilities, for Moly claimed that it was the parent used by Jones and Fox to produce their new race of *plumosum divisilobum*, the finest ever raised. However, Col. Jones found many decompositums himself and from one of these raised a plant also named *decompositum splendens* which without doubt was the real parent. One wonders if this fern still lingers on in some corner unrecognised. Another thought intrudes: how often during hunting in the post-war years have we stopped to look at a *decompositum* with similar potentialities and discounted it at its face value.

Although the best known, Moly's *splendens* was by no means the best looking of the named decompositums. Wollaston's *laxum* was a large-growing plant with the tripinnate character more fully developed; the Nature Print shows it to be fully fertile, as is also Padley's *tripinnatum*, a much more graceful plant with beautifully developed pinnules. Yet these plants do not appear to have been capable of emulating the achievement of Jones' *splendens*.

Into this section can also be placed all varieties classed as *multilobum* and *conspicuilobum*. As the names indicate, the lobes of their divided pinnules are many and conspicuous, but these characters in themselves are not outstanding enough to make them particularly sought after and I cannot find that any named forms are still grown.

We now move on to the sections *acutilobum* and *divisilobum*. The name *acutilobum* is often given to varieties with acute undivided pinnules but these belong more appropriately to *lineare* in Group 3. This leaves us with two very similar sections which will be considered together as it is difficult to draw an exact line between them. The definitions are Wollaston's, and by almost general consent were accepted by all hunters and growers. The differentiating character of larger lower pinnules in *divisilobum* is rather a weak point, as borderline plants in certain years or in different cultural conditions may have longer or shorter lower pinnules. Padley considered there should be two classes — *decompositum* and *acutilobum*, the latter to include *divisilobum*. However, even though it is difficult to allocate some varieties with certainty, it still cannot be denied that there are two definite sections, with *divisilobum* showing much more highly developed pinnules, and Wollaston's arrangement cannot be bettered.

Acutilobes are still to be found fairly frequently as wild plants and post-war hunting has produced a few. Usually they have been found on dryish banks as quite dwarf-growing plants and have not been very distinctive, their quality being more suggestive than actual; in fact, *lineare* described them

better than *acutilobum*. Several have been collected during hunts, chiefly because there was nothing better to collect and we wished to have something to take home with us. Growing these plants has convinced me, particularly after last year's cool and wet summer, that we have been wrong to regard them lightly. My first *acutilobum* found in 1953, developed some years later into a plant of quality almost rivalling Dr Stansfield's ' Howley Acutilobe ', a first-rate find of 1914. A few years later, other finds, dwarf-growing in dry banks, were transplanted in my borders and have grown in size year after year until the past summer when they excelled themselves. One has developed into a fine proliferous *acutilobum* with finely divided but not very narrow pinnules, another has extremely narrow fine pinnule segments giving it an appearance of grace and lightness, while another has retained the *lineare* character, but has become a really good specimen of its kind. Close watch will be kept on all these plants to see whether they retain their high standard in future years.

One of the best known of the many wild finds of *acutilobum* is that found by Wollaston in Devon in 1852, *acutilobum proliferum* Wollaston. At one time it was thought that only the acute-lobed varieties were proliferous and all were classed accordingly as proliferums. It was later discovered that this tendency to produce bulbils was shared by many other forms of the species, including some of the normal ones, and the name lost its appropriate-ness when applied to the acutilobes. However we still associate the proliferous habit with *acutilobum* more than any other type of variation and the well-known named varieties possessed the habit; these included *P. s. acutilobum* Gray and six examples of *P. s. a. proliferum*, of Allchin, Choule, Dadds, Hartley, Wills and Wollaston. That so few really good finds were made points to the fact that most of them are very much alike and it may be that, with few exceptions, this quality in *setiferum* is a rather inconstant one. My own finds mentioned above may prove this to be so if they fail to hold the standard achieved last year.

Named acutilobums surviving today are few. I am told that the Allchin and Hartley varieties can be obtained, but it seems that, so far as the name is concerned anyhow, Wollaston's has disappeared. Many plants very similar can be found flourishing in fern collections named only *acutilobum* or *acutilobum proliferum*, so it would seem reasonable to assume that this vigorous variety is still with us. However, as the members of the section are so very much alike, even to the proliferous habit, unless they can be definitely identified, or have some distinctive quality to lift them above the others, it is better that they remain unnamed. The few acutilobums in my collection are without names (e.g., Fig. 1) all bulbiferous and similar in appearance and it is quite possible that they are survivors of the named coterie. I am quite content to leave them incognito.

When we come to *divisilobum* we find that the species has been much more active. Lowe's list of variations is longer than any of his other *Poly-*

stichum lists and all following lists are the same, including those in nursery catalogues. And still today *divisilobum* seems to have survived better, possibly because of its greater beauty. What I said in my opening remarks to Division B applies most of all to this section. In *divisilobum* pinnule division has run riot, splitting up into a multitude of fine segments, pinnae and pinnules all overlapping to give the fronds the appearance of great plumes. Many, too, are proliferous and the tiny fronds bursting from the bulbils along the rhachis add to the effect. One of the finest is *divisilobum* Bland, easily obtainable and propagating true from its innumerable bulbils. This fern was found in Ireland and is by far the best wild find in the section. To find a wild *divisilobum* has been an ambition of hunters since the cult began and the finds were many, chiefly in the West Country. Today the most intensive hunting in that area fails to produce a single specimen! Outstanding forms were found by all the great hunters of the last century, notably Elworthy, Jones, Moly, Padley and Wills, but none of them were as dense as ' Bland ' and none seem to be living today, at least not as named specimens. The failure to ensure the safe disposal of the last great collection was their death-knell. Plenty of unnamed divisilobums, mostly seedling plants, are to be seen in gardens today and are comparatively easy to obtain.

From the beginning both nurserymen and amateurs were busy raising new plants from spores and bulbils. The outstanding work in this field was by Jones and Fox, who evolved a new race of plumose divisilobes by breeding from a wild find of *decompositum*. These surpass ' Bland ' in their development and the finest of them, *Baldwinii*, although no longer available in the original, has passed on to us much of its refinement in its progeny which still exist under the same name. Other named divisilobes obtainable are:

P. s. plumoso-divisilobum, Esplan type, rivalling *Baldwinii* when well grown.

P. s. divisilobum densum, dwarf-growing, plumose.

P. s. divisilobum Iveryanum, crested.

P. s. divisilobum longipinnatum Carbonell (Fig. 2), slender and graceful with very long lower pinnules.

P. s. divisilobum decorum, very finely cut.

P. s. divisilobum grandiceps, with a heavy crested head.

Group 3 **All other pinnule changes**

This group gathers together all the remaining worthwhile types of *setiferum* variation and, apart from *lineare* section which contains plants with simple clean-cut graceful and symmetrical lines, forms rather an anti-climax. The old-time *lineare* lists contained many irregular rogues with ragged, rudimentary and missing pinnules, most of them fit only for the rubbish heap. The section is exemplified by ' Hirondelle ', one of Moly's

finds, so named from the striking resemblance of the pairs of opposite pinnules to swallows in flight. ' Hirondelle ' was far from robust and is now no more. Many *lineare* plants are in cultivation however, strong-growing and approaching ' Hirondelle ' in beauty. Some are named *gracile* but the majority are wrongly included under *acutilobum*. Good specimens can be found in the wild.

Rotundatum is the opposite of *lineare*, with broad rounded pinnules. Good forms are distinctive and should be strong-growing, so are probably fairly common in gardens. I cannot find that they have survived as named specimens. *Crispatum* has been noted at times in the wild in recent years but no extreme forms worthy of collection and naming have been seen and I can find no trace of any in cultivation. *Setosum* can be regarded as a fuller development of the spininess of the normal species; named forms have not survived; the character is quite a familar one in wild colonies and, rarely, one is seen which is admired but is not extreme enough to be collected. In this section can be included *serratum* and *perserratum*, the deep-cut saw-like edges of the pinnules giving a similar spiny look to the fronds; again, there were a few named forms but none are grown by name today.

It is hoped that this brief survey will help to give a clearer picture of variation in *Polystichum* and remove some of the nomenclature confusion. It may enable some members to identify unnamed plants in their possession, plants which excite curiosity and are cherished for their rare beauty or unusual form. Perhaps some of the treasures which we mourn as lost will be brought to the light of day. If so, my labours will be well rewarded.

REQUEST

POLYSTICHUM VARIETIES

As may be appreciated from the foregoing account, the tracking down of fern varieties is an arduous task.

Anyone who can provide evidence of living specimens of *Polystichum* varieties is asked to communicate with J. W. Dyce, Hilltop, 46 Sedley Rise, Loughton, Essex.

Dried fronds with data are particularly desirable; for some instructions on drying and labelling see *Gazette* 9: 27.

MEIOSIS IN ASPLENIUM X MURBECKII FROM BORROWDALE

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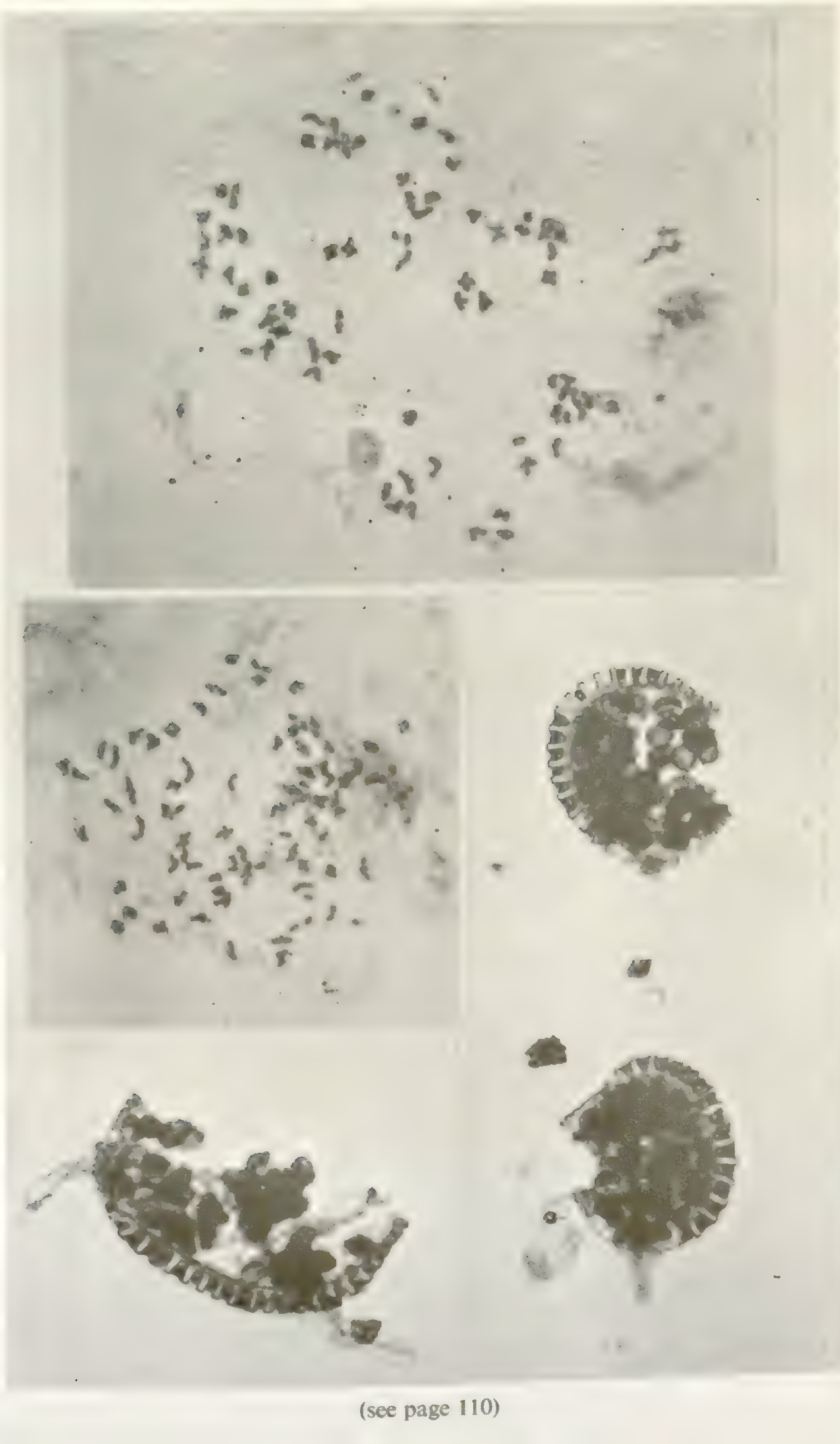
INTRODUCTION

The hybrid between *Asplenium ruta-muraria* L. and *Asplenium septentrionale* (L.) Hoffm., *A.* × *murbeckii* Dörfler, is certainly of very rare occurrence in Britain and there are indeed very few authenticated records. Undoubted specimens of *A.* × *murbeckii* originating from Stenton Rock, near Dunkeld, Perthshire (1853 and 1858) and from Arthur's Seat, Edinburgh (1861) are preserved in the Moore Herbarium at Kew but as far as I am aware, prior to Mr Fred Jackson's discovery of a specimen on Castle Crag in Borrowdale, this hybrid had not been recorded in Britain during this century. There is an earlier but until now unrecognised specimen of this hybrid from Borrowdale in the British Museum Herbarium, collected in 1927 by H. W. Pugsley, but mistaken for *A.* × *alternifolium* Wulfen. Diminutive forms of *A.* × *murbeckii* (and all the known British specimens merit this description) have much the same aspect as small forms of *A.* × *alternifolium* and these two hybrids can in fact readily be confused. However, *A.* × *murbeckii* may be simply distinguished from *A.* × *alternifolium* by the minutely serrate tips of its pinnae, the several individual fine teeth being narrowly acute or even lanceolate. In *A.* × *alternifolium* the tips of the pinnae are more rounded, and where teeth are present these are obtuse or subacute.

It is quite evident that Mr Jackson's discovery (Jackson 1961) is a significant event in the study of British ferns and he should indeed be congratulated. Very generously, Mr Jackson sent a portion of his plant to the Chelsea Physic Garden and subsequently another portion to the Botany Department Experimental Garden at Leeds. This plant has not yet been fertile since its arrival in Leeds, neither has the Chelsea plant produced any fertile fronds since 1961. It would seem that this hybrid does not thrive in an urban atmosphere, even within the protection of a greenhouse. The Leeds plant was certainly visibly damaged by the appalling week of con-

EXPLANATION OF PLATE I

Figs. 1 and 2. Permanent aceto-carmine preparations of diakinesis in *Asplenium* × *murbeckii* from Castle Crag, Borrowdale. Magnification × 1000, photographed with Leitz 2 mm N.A. 1.4 apochromat, with × 10 ocular. Fig. 1, 60 bivalents and 24 univalents. Fig. 2, 62 bivalents and 20 univalents. Explanatory diagrams on text-figures 2 and 3. Figs. 3, 4, and 5. Glycerine jelly mounts of sporangia of *A.* × *murbeckii* from Castle Crag. Magnification × 100, photographed with Zeiss 16 mm apochromat with × 10 ocular. A high proportion of abortive spores are formed, but this proportion varies widely from sporangium to sporangium. Fig. 3. Ruptured sporangium showing mis-shapen spores. Fig. 4. Sporangium showing group of apparently good spores. Fig. 5. Entirely abortive sporangium.



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(see page 110)

tinuous smog at the end of November 1962. It has therefore proved to be very fortunate that Mr Clive Jermy had sent me in May 1961 a fixing taken from the plant at Chelsea. This fixing yielded only a single sporangium in an informative stage but some of the spore mother cells from this sporangium gave clear analyses of chromosome pairing which were both unexpected and interesting. Since it now appears rather unlikely that more fertile fronds will become available in the immediate future and in view of the fact that there is no previous account of chromosome pairing in *A.* × *murbeckii*, it has been decided to present a report on this limited cytological information.

CYTOLOGICAL RESULTS

Preparations were made by the aceto-carmine squash method. As stated above, only one sporangium was found in a stage suitable for study of the pairing of the chromosomes in meiosis. The spore mother cells from this sporangium were in diakinesis. Fourteen cells in all were available for study. Of these, only two have yielded confident analyses. One of these two cells (illustrated on plate I, fig. 1, with explanatory diagram on text-fig. 2), shows 60 bivalents and 24 univalents, the other (plate I, fig. 2, text-fig. 3), shows 62 bivalents and 20 univalents. Though the remaining cells have not yielded accurate analyses, they clearly show the same order of pairing.

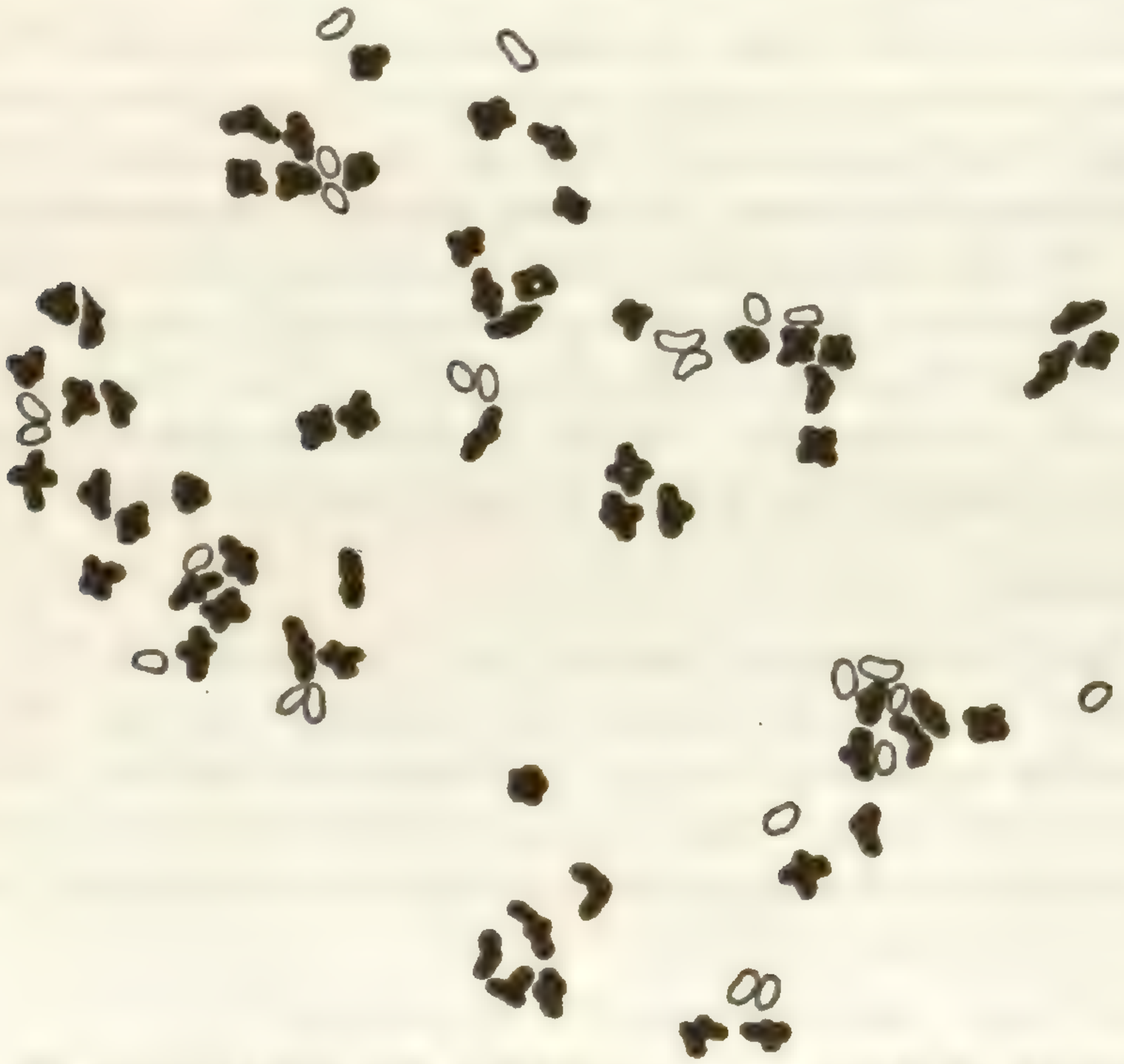
INTERPRETATION

The basic chromosome number (x) in *Asplenium* is 36. Both *A. septentrionale* and *A. ruta-muraria* are tetraploid species with perfectly regular meiosis, constantly forming 72 bivalents at meiosis. The analyses obtained from the Castle Crag hybrid indicate that it is tetraploid, thus giving cytological confirmation of the correctness of identification as distinct from *A.* × *alternifolium* which is a triploid.

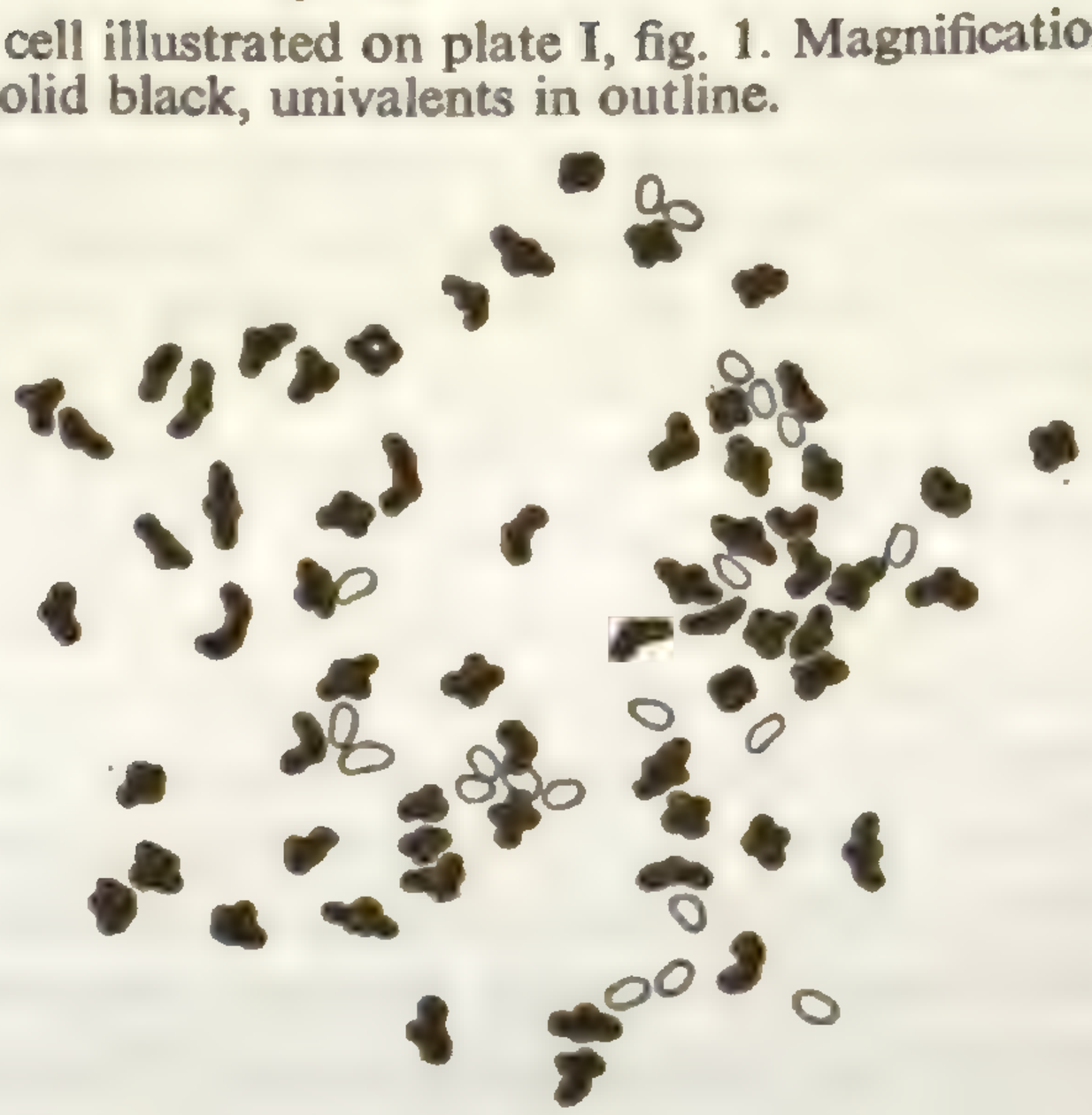
Studies have been made on the chromosome pairing found in the hybrids formed between *A. septentrionale* and the diploid and tetraploid cytotypes of *A. trichomanes* L. and it has been shown that the analyses obtained can only be consistently explained if it is assumed that the two genomes contributed by the *A. septentrionale* gamete pair together in the hybrids formed with *A. trichomanes*. From this conclusion it can be inferred that *A. septentrionale* is of effectively autopolyploid origin. In other words, *A. septentrionale* has arisen from within a single ancestral diploid species by doubling of the chromosome complement (Lovis, in preparation).

There are two possible alternative simple interpretations of the chromosome pairing found in the Castle Crag example of *A.* × *murbeckii*. To clarify the explanation, the symbol *S* will be used for the chromosomes derived from the *A. septentrionale* parent and the symbol *R* for the chromosomes donated by the *A. ruta-muraria* parent. Either all the bivalents are formed by pairing between chromosomes contributed by different parents (i.e., all the bivalents are *SR*), or else the two genomes contributed

Text-fig. 1. Silhouettes (natural size) of fertile fronds of *Asplenium* × *murbeckii* from Castle Crag taken from the division now in cultivation at Leeds on its arrival in the autumn of 1961.



Text-fig. 2. Explanatory diagram to cell illustrated on plate I, fig. 1. Magnification ×1250. Bivalents in solid black, univalents in outline.



Text-fig. 3. Explanatory diagram to cell illustrated on plate I, fig. 2. Magnification × 1250. Bivalents in solid black, univalents in outline.

by each parent are pairing between themselves, (i.e., all the bivalents are *SS* or *RR*).

The first interpretation is less likely since, from other information (Lovis loc.cit.), it has already been inferred that the two genomes present in gametes formed by *A. septentrionale* are capable of pairing with one another at meiosis. Morever, I would not expect *A. septentrionale* and *A. ruta-muraria* to be separated from one another by only a limited number of gene differences, as is probably the case if their chromosomes are capable of pairing together to form as many as 62 of a possible 72 bivalents. If correct, this interpretation would involve a further rather curious inference since, if the assertion that *A. septentrionale* is of effectively autopolyploid origin is accepted and if in fact *A. ruta-muraria* were separated from *A. septentrionale* by only a limited number of gene differences, then it would evidently follow that *A. ruta-muraria* must ultimately be derived from the same origin as *A. septentrionale*, in other words it must have as its ancestor the same single diploid species as does *A. septentrionale*.

The alternative interpretation of the chromosome pairing also leads us to an unexpected conclusion regarding the origin of *A. ruta-muraria*. If the chromosomes of the two genomes from *A. septentrionale* are pairing together (*SS*) to form the maximum possible number of 36 bivalents, then the remaining 26 bivalents must be formed between the chromosomes contributed by the *A. ruta-muraria* parent (*RR*), indicating a high degree of homology between the two genomes present in the gamete of *A. ruta-muraria*. This conclusion would indicate that *A. ruta-muraria* is either a segmental allopolyploid or an ancient autopolyploid. Such a situation, notwithstanding the claim that *A. septentrionale* is effectively an ancient autopolyploid, is nevertheless believed to be of generally rare occurrence amongst ferns, wherein nearly all of the polyploids so far investigated have proved to be typical allopolyploids (Manton 1950, 1961).

It is not possible to arrive at a firm decision here as to which of these two suggested interpretations of the chromosome pairing found in the Castle Crag example of *A.* × *murbeckii* is correct. Equally, it is not possible on this evidence alone to determine just how closely related or otherwise are *A. septentrionale* and *A. ruta-muraria*. Cytogenetic study of hybrids formed between *A. septentrionale* and *A. ruta-muraria* and other species of *Asplenium* may make it possible to resolve these uncertainties.

It is a pleasure to record my grateful thanks to both Mr Fred Jackson and Mr Clive Jermy for their kind and generous co-operation.

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FERNS OF SARDINIA

by

G. J. DE JONCHEERE

Antwerp

In 1960 it was my good fortune to visit Sardinia with my friends Professor and Mrs van Steenis. Botany and holiday were agreeably mixed.

When flying in to Alghero from Rome the fernhunter's eye is struck by the wild uncultivated landscape and the vast expanse of forests still covering the northern part of the beautiful island. The expectation which I felt was certainly confirmed by our subsequent journey. We crossed from Alghero in the west to Santa Teresa in the extreme northeast via Sassari and Tempio, then driving southwards via Monti, Nuori and Fonni to Desulo where we climbed Gennargentu (1830 metres) the highest mountain of Sardinia. Our faithful little Fiat carried us back to Alghero via Abbasanta and Santa Lussurgio. We did not visit southern Sardinia which, being drier and less wooded than the north, is probably less interesting to a pteridologist. Before getting down to botany we saw the Ascension Day pageant at Sassari; representatives from all parts of Sardinia, each in their own local costume, march in procession through the sun-bathed piazza of the old town making a magnificent display for which the island is famous.

From Sassari we went through Tempio to Aggius for our first real botanising. A wild jumble of basaltic rocks hides a wealth of ferns tucked away in cracks of huge boulders shaded by small copses of mediterranean oak and chestnut. *Asplenium adiantum-nigrum* ssp. *onopteris* mingled with *A. obovatum* and although these ferns are both well known they still offer problems.

A. adiantum-nigrum ssp. *onopteris* is quite different from the North European form of *A. adiantum-nigrum* ssp. *adiantum-nigrum*, yet there is a complete sequence of forms without a clear demarcation line right down to the extreme forms in the Canary Islands and Palestine; it seems therefore difficult to regard the mediterranean forms as a separate species and these large plants with pointed elevated segments are possibly best regarded as geographical subspecies. D. E. Meyer (1960) in *Ber. Deutsch. Bot. Ges.* **73**(9):386 suggests that *A. onopteris* should be regarded as a good species; he describes a sterile triploid hybrid between tetraploid *adiantum-nigrum* and diploid *onopteris* (*Asplenium* × *ticinense* D. E. Meyer). However, as there is also diploid *adiantum-nigrum* and as some plants that I collected in Mallorca and Madeira are exactly like *ticinense*, but fertile, I still consider this complex best treated as one species with two subspecies, ssp. *adiantum-nigrum* (diploid and tetraploid) and ssp. *onopteris* (diploid). However, if it can be proved

that the hybrid between diploid *adiantum-nigrum* and *onopteris* is also sterile the case would be reversed and I would agree with Dr Meyer that two real species are involved.

The case of *A. obovatum* is different. Viviani described it from a mediterranean plant, small with rounded segments and diploid. The atlantic forms which Hudson described as *A. lanceolatum* are larger, with pointed segments and tetraploid. The differences are small and it takes a lot of experience to separate them. They were both growing together in Sardinia. Manton & Reichstein (1962) in *Bauhinia* 2(1) state that *A. obovatum* is diploid and *A. billotii* is tetraploid; also, that according to unpublished investigations by Dr M. G. Shivas (Mrs T. G. Walker), *A. billotii* is an alloploid from *A. obovatum* and *A. onopteris;* pending further substantiation I cannot accept that the two plants be treated as different species and prefer to regard them as *A. obovatum* sspp. *obovatum* and *lanceolatum.*

Other ferns seen at Aggius were Bracken and Ladyfern, both ubiquitous. Huge clumps of *Osmunda regalis* in wet places were most impressive and the little annual *Anogramma leptophylla* on earthy banks was a reminder of links with more tropical floras.

The scenery around Santa Teresa is strongly reminiscent of Cornwall, the similarity being emphasised by dark green plants of *Asplenium marinum*, as usual in north-facing seacliffs; this fern is rare in the mediterranean and Sardinia is one of its most easterly localities; it is always worthwhile to look further above it for *Asplenium obovatum* as the two often grow together, albeit on different levels. It is curious that in Santa Teresa, so far away from the British and French coasts, the same association was found; if one had not seen this before one would be tempted to regard it as a very curious habitat for *A. obovatum* which otherwise grows everywhere in Sardinia in rockfissures and hedges, if not too dry and high.

We climbed Monte Corrasi (1460 metres) from the old village of Oliena and we drove by car practically to the top of Monte Limbara (1360 metres). Their dissimilarity is striking. Corrasi is limestone with a large bare plateau on the summit and treeless through generations of herdsmen grazing their goats and sheep; Limbara is basalt and the vegetation resembles North European heathland. Limbara was not very exciting pteridologically but *Athyrium filix-femina*, *Dryopteris borreri*, *Cystopteris fragilis*, *Asplenium trichomanes* and *Polystichum setiferum* again showed North European ferns finding suitable terrain in a mediterranean locality. It was not surprising to find *Asplenium ruta-muraria* on the top of Monte Corrasi; this is rare in Sardinia and not recently reported as far as I know; other limelovers found there included *Ceterach officinarum*, *Adiantum capillus-veneris* and *Dryopteris villarii* which latter, as found in Sardinia and southern Italy (var. *australe* TEN.), is different from the well known fern of the Alps which is also found rarely in Great Britain on limestone pavements; var. *australe* is distinct in

its ecology, appearance and morphology and there is maybe a good case for elevating it to specific rank, as was done by Guadagno. I did not find *Phyllitis hemionitis* on Monte Corrasi but it was growing in small pits eroded out of a huge limestone boulder near Ittiri; very small plants of *Asplenium trichomanes* had also settled there and as the habitat was so uncommon I thought at first I had found *A. petrarchae*, up till now not recorded from Sardinia; alas, no, but it could be found there as it is known from Sicily and the coast near Salerno.

The pièce-de-résistance of our trip, the climbing of Monte Gennargentu, proved to be arduous and long. We were guided by an old herbalist from Desulo, where the women still wear their vivid red and yellow costumes in ordinary life. *Blechnun spicant* and *Asplenium septentrionale* emphasised the northerly atmosphere of this old volcanic mountain but the most striking feature was *Athyrium filix-femina* forming broad vivid-green splashes in the shade of alders along streamlets rushing down to warmer places.

For me it is always a thrill to find *Isoetes*. Sardinia is a well known locality for these plants and we found two amphibious and one aquatic species. Between Monti and Nuero, shallow hollows in the meagre pastures, still damp in May but certainly dry in midsummer, produced *I. hystrix* and an unidentified species. The only freshwater pool we saw north of Alghero was fringed with numerous thriving plants of *I. velata* among lush water-plants and algae; in Northern Europe *Isoetes* is strictly confined to oligo-trophic waters but this pool was strongly polluted with cow and sheep dung; the amphibious species were found in heavily grazed land but Professor van Steenis assured me that the vegetation was typical *Isoetes*-association.

Apart from *Isoetes*, *Selaginella denticulata* which is very common and a few plants of *Equisetum ramosissimum*, no other fern allies were seen. *Polypodium australe* was common, *P. vulgare* grew high up on Monte Gennargentu and *Pteridium aquilinum* was reminiscent of landscapes in Great Britain.

In conclusion I thank Mr Clive Jermy (British Museum, Natural History) and Dr D. E. Meyer (Botanical Museum, Berlin-Dahlem) for their help with *Isoetes* and *Asplenium* respectively and Professor and Mrs van Steenis for organising the trip and for their invaluable botanical advice and friendship.

BRITISH FERN NOTES

A HYBRID HORSETAIL FROM THE HEBRIDES

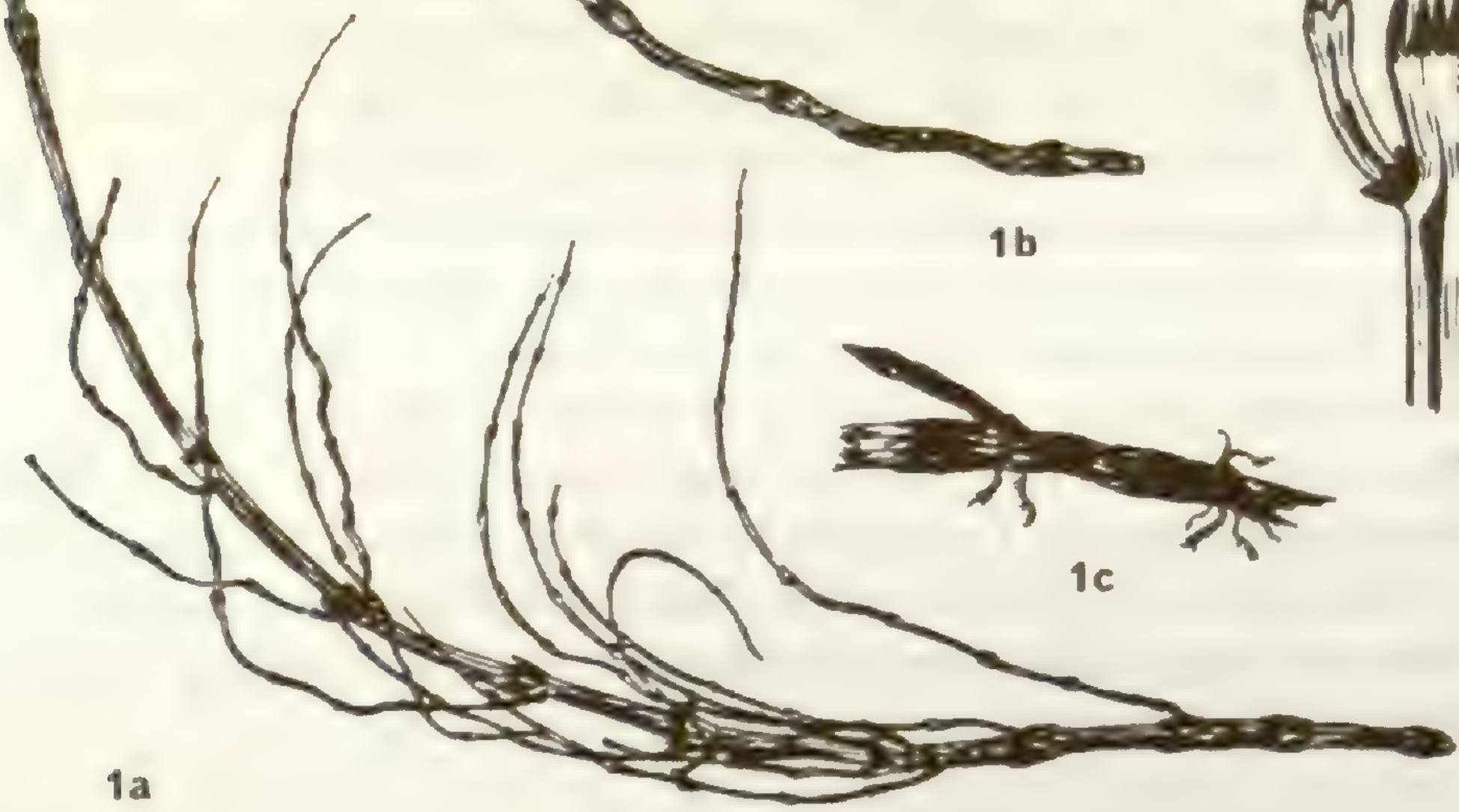
While collecting plants in Harris in the Outer Hebrides during the summer of 1962 I had the opportunity of obtaining a number of horsetails, many of which grew in profusion in certain localities in the area, mainly on roadside verges and in ditches. The rainfall is sufficient in Harris to maintain over most of the area a permanently waterlogged soil and the gradients steep enough for there to be a continual run-off of peaty water, the streamlets and roadside ditches seldom, if ever, running dry.

In a small area of one such ditch grew several dozen specimens of a horsetail which appeared at first sight much like *Equisetum variegatum*. It consisted of simple or sparingly branched stems (text-fig. 1) arising out of the mud and growing prostrate over it for about half their length and then curving upwards. All the stems were sterile, dark green and 6 to 18 inches long. Closer inspection of the stem revealed a greater likeness to *E. arvense* or *E. palustre*.

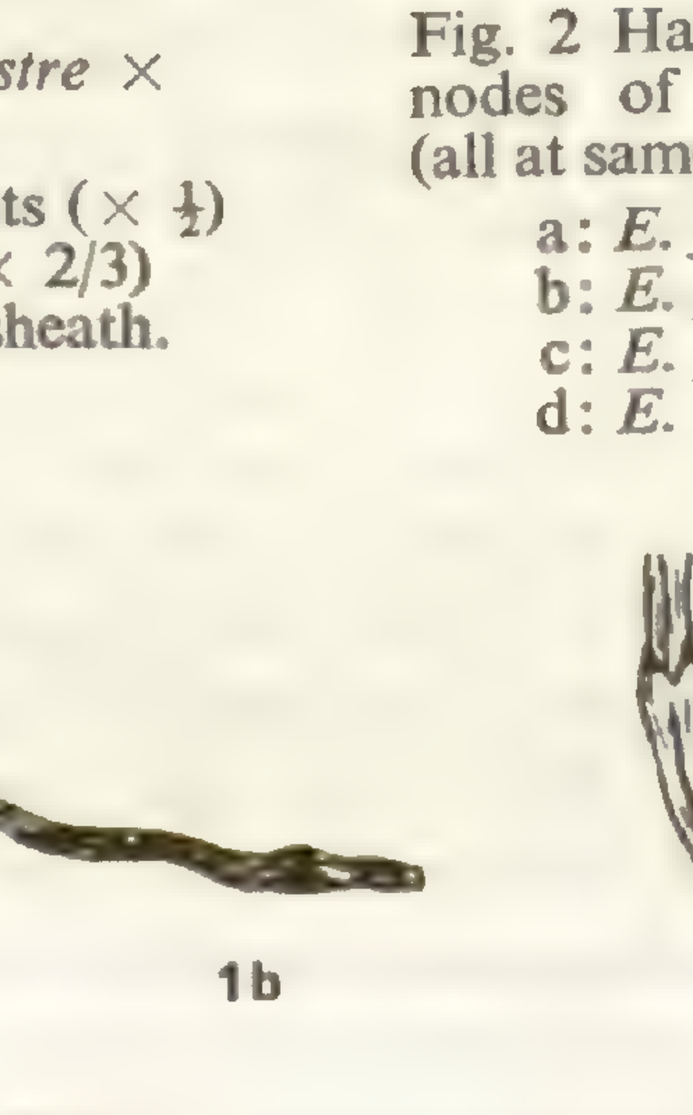
This small colony grew about 300 feet away from a larger colony of *E. palustre* which had upright-growing stems mostly regularly branched and which at this time of the year (late August) still bore withered cones. Within a mile radius of this spot were also to be found *Equisetum fluviatile*, *E. sylvaticum* and *E. arvense* and slightly further away *E. telmateia*, though only *arvense* and *palustre* grew in any number.

The identity of this horsetail was uncertain from external appearance so, from pickled material, I took sections of the internode of the aerial stems; these appeared totally unlike those made for comparison from local specimens of *palustre*, *arvense* and *fluviatile* or any other horsetail (text-fig. 2). The sections most resemble *E. palustre* in having a small number of rounded ridges (about 9) with shallow furrows between, rounded vallecular canals and about the same overall stem diameter (2mm.). The sheath and teeth appear almost identical with those of *palustre*. The first internode of the branch is slightly longer than the stem sheaths. It appears to resemble *fluviatile*, however, in the fact that the endodermis, which in *palustre* and *arvense* is continuous around the whole set of vascular bundles, here surrounds each vascular bundle separately, there being no link between the bundles. This condition is also reported in *E.* × *litorale* (*arvense* × *fluviatile*). The ratio of the size of the central hollow to the diameter of the stem appears to be intermediate between that of *palustre* and *fluviatile* (more nearly like *arvense*). The branches are 4 - 5 grooved and hollow. The arrangement of the silicified sclerenchymatous tissue differs from that of *palustre*, *arvense* or *fluviatile*. There is a large amount of this tissue at the ridges linking with a smaller amount in the furrows between.

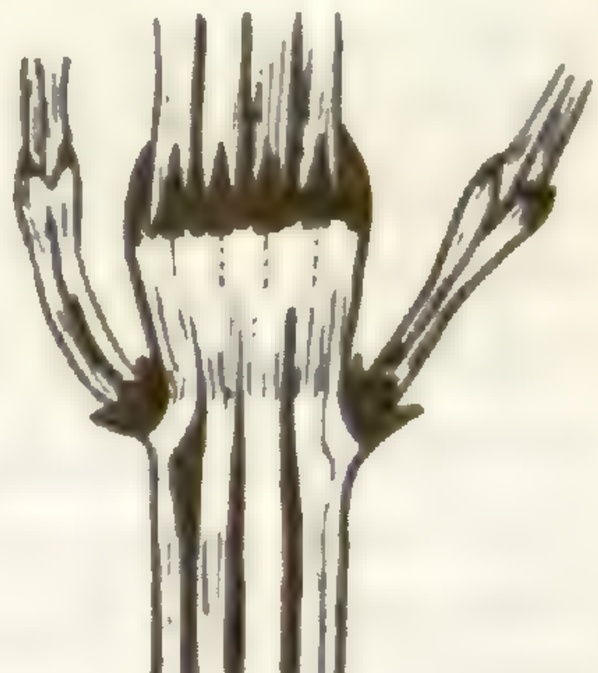
1a



1b



1c



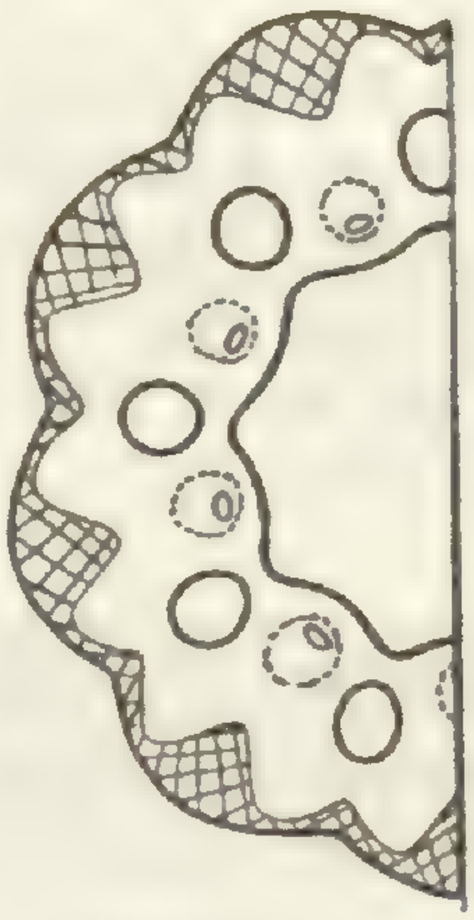
1d

Fig. 1 *Equisetum palustre* × *fluviatile*

a, b: aerial shoots (× ½)
c: rhizome (× 2/3)
d: node and sheath.

2a

2b



2c

2d

Fig. 2 Half-sections of internodes of *Equisetum* shoots (all at same magnification)

a: *E. fluviatile*
b: *E. palustre*
c: *E. palustre* × *fluviatile*
d: *E. arvense*.

These features appear not to tally with those described for any species and appear to be somewhat intermediate between *palustre* and *fluviatile*. It may therefore be a hybrid, growing as a separate colony, its parents being absent in the immediate vicinity. This plant clearly needs some further investigation.

KING'S COLLEGE, NEWCASTLE C. N. PAGE

NAME CHANGES IN THE BRITISH FERN LIST

14.*2* **Asplenium billotii** F. Schultz in *Flora* **27**:807; **28**:738 (1845). Manton and Reichstein in *Bauhinia* **2**:79-91 (1962) have shown that the complex known lately as *A. obovatum* Viv. (incl. *A. lanceolatum* Huds.) in Europe consists of two species, a diploid and a tetraploid. The diploid has a mediterranean distribution and is the plant described by Viviani from Corsica as *A. obovatum*. The tetraploid is *A. billotii*, found in the British Isles and over a wider area on the Continent, described from a French (Vosges) specimen; Manton suggests it is an allotetraploid with *A. onopteris* as one parent. True *obovatum* differs from *billotii* in having shorter, more triangular pinnae with fewer and less distinct pinnules; it may turn up in the Channel Isles or in the SW peninsula, but so far has not been recorded from the British Isles.

18.*2* **Athyrium distentifolium** Tausch ex Opiz in *Kratos* (Zeitschr.f.Gymnasien. Prag.) **2**(1):14 (1820) must replace *A. alpestre* Clairv. (1811). Clairville's type specimen at Zürich has been examined and identified as *A. filix-femina* (L.)Roth.

21.*6* **Dryopteris carthusiana** (Vill.) H. P. Fuchs in *Bull.Soc.Bot.France* **105**:339 (1958). *D. lanceolatocristata* (Hoffm.) Alston is now considered to be a possible hybrid between *D. carthusiana* and *D. cristata*. The type specimen of *Polypodium lanceolatocristatum* Hoffmann cannot be traced. *Polypodium carthusianum* Villars, *Hist.Pl.Dauph.* **1**:292 (1786) is the next available name.

24.*4,5* **Gymnocarpium dryopteris** (L.) Newman and **G. robertianum** (Hoffm.) Newman in *The Phytologist* **4**:371 (1851). Stipe anatomy, scale and frond structure and chromosome number are distinct from *Thelypteris*. Most pteridologists regard these species as probably more correctly placed in *Aspidiaceae*.

BRITISH MUSEUM (NATURAL HISTORY) A. C. JERMY

SHORT NOTES

PSILOTUM TRIQUETRUM IN BASUTOLAND

Psilotum is usually a tropical epiphyte. Sometimes it grows non-epiphytically and, as Manton [1] says, "they are familiar objects in most botanic gardens since they are fairly easy to grow and, in addition, reproduce themselves by bulbils". This record of *Psilotum triquetrum* (*P. nudum*) growing non-epiphytically in Basutoland, whose climate cannot be described as tropical, seems noteworthy.

Following mention by the Rev. J. Gomes, O.P., that *P. triquetrum* had been seen growing in Roma Valley, Basutoland, possible locations on the eastern escarpment of the Cave Sandstones flanking Roma Valley were searched in November 1961; it was found in only one place (recorded on a grid-map) at about 5650 feet altitude as a colony of eighteen stems arising from deeply implanted mycorhizal rhizome in a cleft in a rockface in running water. The infertile stems were more divided and had more rigid pointed leaves than the seven fertile stems of the colony. Basutoland specimens of *P. triquetrum* are in the herbaria of University College, Roma, Basutoland and the British Museum (Natural History).

Other records of *P. triquetrum* in southern Africa include Port St. John's (Cape Province) and Pondoland [2], Natal [3], Southern Rhodesia and Ghana.

UNIVERSITY COLLEGE, BASUTOLAND D. MORGAN

LEAF-BASE PROPAGATION OF *PHYLLITIS SCOLOPENDRIUM*

C. T. Druery, in the third chapter of his *British ferns and their varieties*, described leaf-base vegetative propagation of ferns, an invaluable method when for any reason division of crowns or growing from spores is impractical or impossible. *Phyllitis scolopendrium* and its varieties are particularly adaptable to this method which, over many years, I have used most successfully.

Lift the parent plant, preferably in spring, shake off the soil, divide into single crowns, trim each to three inches of stem and replant. The severed portions of stem provide the material for propagation. Wash them thoroughly. Starting at the bottom, cut away until plump frond bases about an inch long are reached; detach them by carefully snapping off or by under-

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[1] Manton, I., *Problems of cytology and evolution in the Pteridophyta.* 1950.

[2] Jacot-Guillarmod, A., *personal communication.* 1961.

[3] Sim, T. R., *Ferns of South Africa*, ed. 2. 1915.

cutting with a sharp knife. Cut off any roots, trim neatly down to green tissue, wash thoroughly in cold water and spread them half-an-inch apart over clean wet sand one inch deep in a clean lidded plastic box or a glass jar covered with polythene tied on with rot-proof material (not rubber bands as these soon perish and snap). Place the box or jar in a light but shady position away from direct sunlight. After a month or six weeks up to about twenty pimples should appear on each leaf-base, to develop into tiny plants. When the plantlets are well rooted, open up the container, detach them and prick out into boxes or pans of open compost; keep covered for a few days before gradually hardening off; grow on until large enough to prick out again further apart or into thumb pots. At no stage must the plants be allowed to get dry. The following year the plants should be big enough to put into a shady border and in two years may be handsome subjects.

From one original plant I have been able, in one operation, to raise hundreds of progeny which, being vegetative fragments, truly bear all its characters.

SILVERDALE, LANCS. REGINALD KAYE

BOOK NOTES

WELSH FERNS — A DESCRIPTIVE HANDBOOK by H. A. Hyde and A. E. Wade; 4th edition, pp. ix, 122, 12 plates. National Museum of Wales, 1962. Price 15 shillings.

Since the publication of the first edition of *Welsh ferns* in 1940 this work has been a handbook for all interested in finding, identifying and growing ferns. This latest edition has been fully revised and rearranged, with two exceptions, according to J. E. Dandy, *List of British vascular plants* which incorporates the views of the late A. H. G. Alston; the authors recognise *Gymnocarpium* as a genus distinct from *Thelypteris* on both cytological and morphological grounds, although they do retain it in *Thelypteridaceae* despite other opinions of closer affinity to *Aspidiaceae;* the *Polypodium vulgare* complex has been treated according to the work of Manton and Shivas, published after Dandy's *List*.

As in previous editions the Introduction (pp. 1 - 28) includes an excellent account of the life-history of the Malefern and of fern morphology and geography. In the remaining pages 23 genera in 13 families are treated species by species. There is a key to genera and there are keys to species;

line drawings and several excellent photographs illustrate diagnostic characters of most species; the text gives a full description of the species, its habitat and distribution, first and foremost in Wales but also in the British Isles and the World. In spite of the title the book covers the fern flora of the British Isles; those species not occurring in Wales are described in smaller type and are included in the keys but are not illustrated; however, Wales has such a good fern flora that this means only 6 species out of the 51 described have had to be dealt with in this way.

The biggest disappointment is that the publishers have not seen fit to include horsetails, quillworts and clubmosses in this new edition, to make the work a concise treatment on *Pteridophyta*. The price has been doubled, mainly due to large parts that needed re-setting; the binding is the stouter standard round spine type, but there was something to say for the flush cut boards and cloth spine of the third edition when it came to packing it into a rucksack. Nevertheless it is very good value and its attractive dustcover and crisp typography throughout make it a neat book and once bought I doubt whether it will spend much time on the shelf.

THE FERN GUIDE by Edgar T. Wherry; 318 pp. Doubleday Nature Guide No. 9, New York 1961. Price 3.95 dollars.

This book by a former president of the American Fern Society covers those ferns and fern allies found in NE and midland U.S.A. and adjacent Canada; 135 species are described and illustrated with line drawings. I thoroughly recommend this to British fern enthusiasts; Professor Wherry, also an expert gardener, includes cultivation notes for each species; there are many that would be worth growing in the British Isles.

HOW TO KNOW THE FERNS by Frances T. Parsons; " second edition ", 215 pp. Dover Publications, New York; Constable, London, 1961. Price 1.25 dollars.

With the exception of the omission of 6 photographs, this is a reprint of the 1899 edition published by Scribner & Sons. 57 North American species, grouped into 6 categories based on position of sporangia, are described and illustrated with 103 line drawings and sketches. In spite of some out-of-date nomenclature and a restricted use in the British Isles, this book by a fern lover of older days makes interesting reading with its many observations from living and dried specimens and from literature.

A. C. JERMY

REQUESTS

PILULARIA GLOBULIFERA

Pillwort or Peppergrass is sporadic in its known distribution although, being easily overlooked because of superficial resemblance to small grass or rush, it may in fact be more evenly distributed than the records show. It is spasmodic in its growth, often perennating for years by means of a tough impervious indusium around each of the four sori within each sporocarp " pill ".

It is usually found in soft sandy acid soil at the margin of standing water, when it usually bears one-eighth-inch spherical hairy sporocarps, at ground level. Sometimes it is submerged and is then mostly without fruit, but the circinnate vernation of the unrolling threadlike leaves distinguishes it with watchspringlike leaftips.

Fresh material, packed in plastic with no loose water and sturdily wrapped, together with details of locality, habitat, etc., is required for a study of the biology of this species. If requested, I would gladly refund any postage.

BRITISH PTERIDOLOGICAL SOCIETY

Although the bones of the Society's history are reasonably well known, finer details of flesh and feature are obscure. Apart from several facts scattered through the *British Fern Gazette*, some of which are mentioned on pages 135–6 of this number, there are many episodes which must have been interesting. For example, CHARLES THOMAS DRUERY (1843–1917) crossed swords somewhat with the Linnean Fern Chapter (later the American Fern Society) whose *Fern Bulletin* (later the *American Fern Journal*) was virtually the progenitor of the *British Fern Gazette*. Who was WHILHARRIS who collected a plumose polypody near Glastonbury in the 1890s (*Gazette* **5**:93;**7**: 33)? How and where did the West of England Pteridological Society operate?; was it centred partly at Chislehurst with GEORGE BUCHANAN WOLLASTON (1814-99) and partly at Clifton, Bristol with Colonel ARTHUR MOWBRAY JONES (1826-89)? Is there any detailed record of Colonel Jones's method of natureprinting? What sort of people were the well known names of the Society, several of whom are mentioned on pages 97–108 of this *Gazette*? Biographical and genealogical clues must surely lie in such places as local newspapers and flyleaves of family bibles and fern books.

Any information, cuttings, photographs, etc., would be most useful to me for compiling a history of our Society.

BRITISH MUSEUM (NATURAL HISTORY) LONDON SW7 J. A. CRABBE

THE SOUTHPORT FLOWER SHOW 22 - 24 August 1962

Professor Holttum writes:

This was my first visit to Southport so I have no previous experience from which to make comparisons. The day was sunny but with a cool and blustery sea breeze which I met as I walked along the esplanade admiring the spacious and varied gardens and recreation areas into which the coastal belt of sand-dunes has been transformed. At the Show I soon found my way to the Society's stand in tent No. 2 where I received a warm welcome from Messrs Hayhurst, Jackson (senior and junior) and Robinson, who had brought a varied selection of plants to attract visitors. Another of our members, Mr R. Kaye, had his own exhibit, including ferns, in another part of the Show; he was one of the judges of the fern classes.

Messrs Brookfield's plants in Class 8 were suitably varied and of a high general standard, but I felt that the whole presented the effect of a collection of plants rather than a group arranged to give unity of design, admittedly a difficult effect to achieve and perhaps I am unduly critical.

In general, I was impressed with the excellence of the plants and by the fact that they were collectively so representative. The following notes on individual species and varieties may reflect my own particular interests and prejudices. Perhaps I should preface them by a word about names. Most members of the Society are probably better versed than I am in the intricacies of varietal nomenclature, but I doubt if anyone now remains who has a knowledge comparable with that of Charles Druery and other founder members of our Society or whether it is really possible to name every plant precisely in accordance with Druery's list; it needs experience to know how much variation may occur in a single plant. After returning from Southport I spent a morning looking over the books of Moore and Druery and also the earlier issues of the *British Fern Gazette*, supplemented by consulting Thomas Moore's fern herbarium which, of course, does not contain some later varietal names listed by Druery. I found almost all the names given to exhibits at Southport, but I am not sure that all were properly applied; and there were some exhibits which had no varietal names.

The plants which I found most attractive were the Polystichums, which included a fine example of what I regard as the most elaborately elegant variety of any British fern, namely *P. setiferum divisilobum plumosum deltoideum* (see frontispiece of *Gazette* vol. 5, no. 12, June 1929). There were others of the *divisilobum* group which were apparently *divisilobum densum*. There were also two good examples of both pulcherrimums, named ' Moly's Green ' and ' Bevis ', and one named *Wakeleyanum*. Contrasting with these, the rather austere open branching of a *Polystichum* labelled *gracillimum* (is this *P. aculeatum pulcherrimum gracillimum* of the *Gazette*, vol. 1, no. 10, Dec. 1911 ?) was very pleasing.

There was also much excellent variety in the Polypodium exhibits, though the much-dissected var. *cornubiense* (or *elegantissimum*) did not come near the size of specimens in Moore's herbarium. The largest Polypodium plant (from Brookfield) had no varietal name; it was like a large *P. interjectum* (see *Gazette* vol. 9, part 3) with rather strongly crenate segments. There were also crested varieties and some fine forms of var. *cambricum.*

Of Scolopendrium there were several varieties, but these all seem to me to distort the form of the original species without adding anything in elegance. Mr Jackson had one which showed repeated forking in a very interesting way; it was perhaps var. *conglomeratum.*

There were several beautiful exhibits of the smaller Aspleniums, including a remarkably well-grown plant of *A. septentrionale* shown by Mr Jackson, a result of our excursion to North Wales in 1961. Mr Jackson showed also a plant of the hybrid *alternifolium.*

Among many Athyriums I was struck by the open branching of *A. filix-femina* var. *Clarissimum* and especially by A.f.-f. var. *plumosum Drueryi* which to my mind is the most beautiful form of this astonishingly polymorphous species. There were a number of crested forms which seem to me to distort the natural form of this species, destroying completely that graceful elegance which is its prime characteristic.

Other native British species exhibited were *Dryopteris villarii*, *Cystopteris fragilis* and *C. dickieana*, *Woodsia ilvensis*, *Cryptogramma crispa* and an unusual form of *Blechnum spicant* with little difference between fertile and sterile fronds.

There were some fine plants among the greenhouse ferns and I was glad to see these; in a cool greenhouse one can grow a large number of species from warmer parts of the earth, some of great beauty and interest. I would like to suggest especially that there are some other species of *Pellaea* which are extremely elegant and not too large which would repay the attention of our members.

In addition to *Adiantum cuneatum* from tropical America and our native *A. capillus-veneris* there were fine plants of an unnamed maidenhair which was said to be ' Kensington Gem ' but I have not found that name in the R.H.S. Dictionary of Gardening.

Pteris cretica was represented by an excellent plant of the typical form of the species and one of a fine crested variety. There were single plants of *Cyrtomium falcatum*, *Asplenium bulbiferum*, *Onychium japonicum* and *Phlebodium* (or *Polypodium*) *aureum* and a very pleasing one of *Davallia canariensis.* Nephrolepis was represented by typical *N. exaltata* and two or three varieties, but none of the more finely dissected ones.

Altogether, a few of our members had put up a quite impressive show.

I hope that more will be fired by their enthusiasm and that this section may once again grow to something like its former dimensions. Members from the south of Britain would find Southport well worth a visit and they would certainly be welcomed by our northern stalwarts.

N. Robinson our Northern Meetings Secretary reports:

From the interest shown by many of the visitors, their questions and discussion, there is no doubt that the decision was a wise one to obtain space for a British Pteridological Society bureau to display various items of literature, application forms for membership and copies of the *British Fern Gazette*. Messrs N. H. Almond, N. Brookfield, B. Hayhurst, F. Jackson, J. Jackson, R. Kaye and N. Robinson provided constant attendance at the bureau in the marquee and at the exhibits in the fern tent and also supplied ferns to decorate the bureau tables. The Society, which benefited by applications for membership and by £1 5s. 6d. from the sale of ferns, acknowledges with gratitude the support given by this group of enthusiasts.

A thunderstorm with high winds and torrential rain on the second day of the show severely affected attendances on the Thursday and Friday. The weather during the summer had been very bad with low temperatures and biting winds and although a few ferns showed signs of wind scorch the exhibitors had performed a magnificent job in cultivating their plants to exhibition standard. Except for a few spelling corrections and abbreviations, the fern names in the following list are as given on the labels.

CLASS 8 A group of hardy British ferns, with accent on diversity and variation, arranged in a natural manner in a space 13 feet by 8 feet and not higher than 6 feet above the ground:
For some years in this class there has been only the most attractive entry of Messrs J. Brookfield & Son who continue to hold the Silver Perpetual Challenge Trophy presented by the British Pteridological Society.

CLASS 9 Six dissimilar hardy British ferns with accent on variation:

1st Messrs Brookfield; *Athyrium filix-femina* 'Druery', *A. f.-f. fieldiae*, *Dryopteris lineata*, *Phyllitis scolopendrium crispum*, *Polypodium cambricum hadwinii*, *Polystichum aculeatum gracillium*

2nd B. Hayhurst; *A.f.-f.cristata*, *A.f.-f.frizelliae capitatum*, *Phyllitis scolopendrium crispum*, *Polypodium cambricum*, *Polystichum setiferum imbricatum cristatum*, *P.s.iveryanum*.

CLASS 10 Three distinct varieties of *Phyllitis scolopendrium:*

1st Messrs Brookfield; *crispum*, *cristatum*, un-named

2nd N. H. Almond; *crispum*, *cristatum*, *hebetatum*

3rd B. Hayhurst; *crispum*, *cristatum*, *ramocristatum*.

CLASS 11 Three distinct varieties of *Polypodium vulgare:*

1st Messrs Brookfield; *bifidomultifidum*, *cambricum hadwinii*, 'Oxford'

2nd B. Hayhurst; *cambricum hadwinii*, 'Oxford', *pulcherrimum*.

CLASS 12 Three distinct varieties of *Polystichum:*

1st B. Hayhurst; *densum*, *divisilobum densum*, *gracillimum*

2nd Messrs Brookfield; 'Bevis', *congestum*, *wakeleyanum*

3rd N. H. Almond; *cristatum*, *imbricatum cristatum*, 'Fishtail'.

CLASS 13 Three distinct varieties of *Athyrium filix-femina:*

1st B. Hayhurst; *cristatum*, 'Druery', *percristatum*

2nd N. H. Almond; *frizelliae*, *frizelliae capitatum*, *victoriae*

3rd Messrs Brookfield; *congestum*, 'Druery', *percristatum*.

CLASS 14 Three distinct varieties of *Dryopteris* and/or *Thelypteris*:
1st B. Hayhurst; *angustata, cristata, ramosissima*
2nd Messrs Brookfield; *angustata, lineata cristata*
3rd F. Jackson; *cristata, linearicristata, ramocristata.*

CLASS 15 Three distinct species and/or varieties of *Asplenium:*
1st F. Jackson; *alternifolium, ruta-muraria, septentrionale*
2nd N. Robinson; *ruta-muraria, septentrionale, trichomanes*
3rd Messrs Brookfield; *trichomanes, trichomanes bipinnatum, viride.*

CLASS 16 Three distinct normal species of hardy British ferns:
1st N. Robinson; *Blechnum spicant, Cryptogramma crispa, Polypodium vulgare*
2nd F. Jackson; *Cystopteris fragilis, Dryopteris villarii, Woodsia ilvensis*
3rd Messrs Brookfield; *Adiantum capillus-veneris, Phyllitis scolopendrium, Polypodium vulgare.*

CLASS 17 One British fern:
1st Dr A. A. Wilkinson; *Polystichum setiferum divisilobum densum*
2nd B. Hayhurst; *P.s.divisilobum densum*
3rd F. Jackson; *Athyrium f.-f.cristatum.*

CLASS 18 Six dissimilar greenhouse ferns:
1st B. Hayhurst; *Adiantum, Cyrtomium falcatum, Nephrolepis, N.exaltata, Onychium japonicum, Pteris.*
2nd Messrs Brookfield; *Asplenium bulbiferum, Davallia canariensis, Nephrolepis, Pellaea rotundifolia, Polypodium aureum areolatum.*

CLASS 19 Three dissimilar greenhouse ferns:
1st B. Hayhurst; *Adiantum* ' Kensington Gem ', *Nephrolepis exaltata, N.plumosum*
2nd Messrs Brookfield; *Davallia canariensis, Nephrolepis, Pteris.*

CLASS 20 One greenhouse fern:
1st Messrs Brookfield; *Adiantum* ' Kensington Gem '
2nd M. Plowman; *Pteris cretica*
3rd B. Hayhurst; *Adiantum* ' Kensington Gem '.

REQUEST

SOUTHPORT FLOWER SHOW

Thanks to the help of our President and of the Northern Meetings Secretary, it has been possible to present the foregoing account of last year's Southport Flower Show. The article on variation in polystichums on pages 97 - 108 emphasises how important are records of the ferns exhibited. A list of winners can be obtained from the Show Committee, but details of exhibits means painstaking work by private individuals.

The Southport Show is one of the major events in the world of horticulture and it is a source of profound regret that so few of us get to see it; we have to rely on other eyes and pens.

In order that a similarly ample and accurate account may be given of future Southport Shows, anyone who is fortunate enough to attend and can offer help is asked to contact the British Pteridological Society's bureau.

BRITISH PTERIDOLOGICAL SOCIETY

MEETINGS IN 1962

BRITISH MUSEUM (NATURAL HISTORY), LONDON, 17 March. 13 members attended. Among many exhibits and informal talks H. J. Bruty spoke on growing ferns from spores, illustrated with living specimens of young ferns in stages from the prothallus.

SAVILL GARDENS, WINDSOR and TAYLOR'S NURSERY, BRACKNELL, BERKSHIRE, 26 May. Led by F. J. Healey on a bitterly cold day 7 members visited the Savill Gardens. Amid the colour of rhododendrons and other early-flowering subjects were seen many British and foreign ferns growing happily in the borders. In the afternoon we were most hospitably entertained by Mr and Mrs Healey at their Bracknell Nursery where we were especially attracted by two specialities, waterlilies in numerous pools and ferns in extensive borders well protected by bamboo hedges.

SOMERSET and WILTSHIRE, 15 - 18 June. This joint meeting with the Botanical Society of the British Isles was based on Wells in the Mendips. The first day was spent exploring the rich limestone gorge at Ebbor and Leigh Woods in the Avon gorge at Bristol where an unsuccessful search was made for the doubtfully recorded *Polystichum braunii*. Shapwick Heath National Nature Reserve was visited on the second day and among the many ferns seen at this classic locality was an enormous *Osmunda* with a circumference of fourteen feet. South Somerset was the venue for the third day when Hamdon (Ham) Hill near Montacute was visited. This rarely botanised area yielded all the usual species, often in great abundance. The last day was devoted to the woods on the Greensand at Stourton on the Somerset - Wiltshire border. Specially noteworthy finds were the rediscovery of *Thelypteris limbosperma* in an old locality and a fine colony of *Equisetum sylvaticum* at the edge of a plantation.

WHITBARROW and LONG SLEDDALE, WESTMORLAND, 14 and 15 July. F. Jackson, J. Jackson, R. Kaye and N. Robinson spent the Saturday on Whitbarrow, the long limestone hill running parallel to the Lyth Valley, an area noted for Red- and Roe-deer and Damson blossom. Most of the lower slopes are boulder-strewn woodland, much of the top is open moorland; there are limestone pavements and evidences of past quarrying. Among the profusion of ferns were extensive stands of luxuriant *Gymnocarpium robertianum* and *Ceterach officinarum*. The weather was fine and 18 species of ferns were seen. On the Sunday N. H. Almond and B. Hayhurst joined the party which visited Long Sleddale, a long narrow valley running into the heart of the hills; many hedgerows and walls were encountered before reaching fells and rocks; in spite of a less favourable terrain and a blustery cold rainy day, 18 species of ferns were again seen including some magnificent clumps of *Cryptogramma crispa*. N. Robinson, the Northern Meetings Secretary, has also made several excursions during the year, including day visits to Whitbarrow and

Warton Crag and a long weekend at Troutbeck near Windermere; 14 species of ferns were noted at Troutbeck.

ROYAL BOTANIC GARDENS, KEW, SURREY, 21 July. Last year's visit to the Kew Ferneries proved so interesting that we included another for this year. Despite reluctant holiday absences, a small party toured the Houses under the expert guidance of H. J. Bruty (Foreman-gardener of the Ferneries), enjoying the sight of so many varied ferns from so many parts of the world. Mr Bruty, an experienced grower with a wide knowledge of the world's ferns, answered our many questions with his customary willingness and charm.

MILL GREEN WOODS, INGATESTONE, ESSEX, 12 August. A party of 15, including members of the Essex Field Club, spent the day in this extensive woodland. 7 species of ferns were recorded in addition to plants of the hybrid *Dryopteris carthusiana* × *dilatata*. *Blechnum spicant*, now in very few places in Essex, was plentiful and some fine plants of *Thelypteris limbosperma* were growing with it. *Dryopteris carthusiana* grew happily in wet places. Other species noted were *Athyrium filix-femina*, *Dryopteris dilatata*, *D. filix-mas* and *Pteridium aquilinum*. Later in the day in a wet wood near Kelvedon Hatch we found *Dryopteris borreri* in association with *dilatata*, *filix-mas* and *carthusiana*.

THE ANNUAL EXCURSION, 8 - 15 September. The Cruachan Private Hotel, Aberfeldy, Perthshire provided an excellent headquarters for visiting the central scottish highlands. Our President and Mrs Holttum took an active part in the daily expeditions. Dr J. Davidson's intimate knowledge of the district was of great help. Other members present were H. J. Bruty, L. Burnett, J. A. Crabbe, Mrs E. M. Dyer, T. A. Dyer, F/Lt P. Halligey, A. C. Jermy, R. Kaye, Miss A. Sleep and Mrs M. R. Stuart. Welcome guests were Mrs R. Kaye and their son Jeremy, Miss M. J. P. Scannell of the National Museum of Ireland and Miss P. A. Sims of the British Museum (Natural History). We were sorry our Secretary was not with us and were grateful to him for making many prior arrangements. Other contributions to the success of the excursion were the hiring of a minibus which provided long distance and local transport, the efficient drying by the Proprietor of masses of wet clothing and, for evening work, the free use of a large room with ample tablespace and fanheaters for warming ourselves and drying our specimens.

The first expedition, on the Sunday, is memorable as a day of record rainfall during a particularly wet summer. It was decided to inspect the famous Birks of Aberfeldy and its waterfalls; perhaps no better description can be given of the Glen of Moness than the poem which gives it its modern name; to quote one verse: " The hoary cliffs are crowned wi' flowers, while o'er the linns [waterfalls] the burnie pours and, rising, weets wi' misty showers the birks of Aberfeldy "; Robert Burns did not mention ferns but they can hardly have passed unnoticed to such a keen observer of nature. We set off at 10 and by lunchtime had worked up the mile or so from the town to the bridge over the main falls. 15 species of ferns had already been found includ-

ing *Phyllitis scolopendrium* on the Crieff Road bridge, *Asplenium viride*, *A. trichomanes* less frequently on wet overhanging rocks and plentiful *Thelypteris phegopteris* and *Gymnocarpium dryopteris;* in higher and drier parts *T. limbosperma* was dominant. Also of interest were a few plants of Wild Basil (*Clinopodium vulgare*); bushes of *Sambucus racemosa* among groves of raspberry canes contrasted with the common elders and blackberries of farther south. It was agreed that the linns were well worth the climb; after lunch most of the party were glad to make their way back to the hotel and dry clothes.

Better weather prevailed on Monday for our first mountain trip. The mountains of the district are composed of mica schist which weathers to a soil of high mineral content and largely accounts for the richness of the flora; a most helpful chapter on this subject is that by John Raven entitled " The mica-schist mountains of the Central Highlands " in Collins' New Naturalist *Mountain Flowers* 1956. The main road runs for 15 miles along the north side of Loch Tay and at Edramucky a road runs up to a carpark at about 1500 feet. From there we walked up to the slopes of the west side of Lochan na Lairige which, in recent years, has been considerably enlarged by damming by the North of Scotland Hydro-electric Board. The activities of the Board are rapidly putting maps out of date; not only have numerous similar large reservoirs been formed but they are augmented by diverting streams in neighbouring catchment areas through tunnels in the mountainsides; interference on this scale must inevitably react on wild life and it will be interesting to learn what changes occur. On the lower slopes Bracken and Malefern soon gave way to *Thelypteris limbosperma* in sheltered positions and small plants of *Blechnum spicant* in the turf, its fronds pressed close to the ground. From about 2000 feet *Lycopodium* and *Selaginella* began to appear. Piles of boulders frequently formed miniature caves whose shelter and moisture had established a microhabitat similar to the damp woodlands below; in such hollows were found *Adoxa moschatellina*, *Asplenium viride*, *Chrysosplenium alternifolium*, *C. oppositifolium*, *Cystopteris fragilis*, *Dryopteris dilatata* (montane, diploid-looking forms) and *Oxalis acetosella.* On exposed rockfaces was *Polypodium vulgare.* Two plants of *Botrychium lunaria* were seen in a small crevice. *Polystichum lonchitis* was fairly frequent and on one ledge was a community of *P. lonchitis*, *P. aculeatum* and young plants; in vain did we search for adult plants of the hybrid *P. illyricum;* material for further investigation at Leeds University was collected. At this time of year most alpine flowers were over and we were not at a station of the real rarities. Nevertheless, *Alchemilla alpina* was so abundant that it often formed a turf, *Saxifraga aizoides* was still in bloom and *S. oppositifolia*, *Sedum rosea*, *Silene acaulis*, *Thalictrum alpinum* and *Cerastium alpinum* were plentiful. *Dryas octopetala* was also found.

On Tuesday we explored a similar mountain area in Glen Lochay. The Hydro-electric Board had provided a road (from grid reference 27/

500370) up which the minibus climbed halfway to the summit, to a small dam which diverts the Allt Dubhchlair. Above this dam the burn cuts through a small ravine where birches have gained a foothold and in whose shelter flourishes an astonishing range of plants in this otherwise barren spot; thus, *Pteridium aquilinum*, *Dryopteris borreri*, *Thelypteris phegopteris* and *Gymnocarpium dryopteris* were found alongside ferns of higher altitudes. After lunch on the open moor the party split into two, particular note being taken by one of them of *Saxifraga stellaris*, 4 alpine *Salix*, *Draba rupestris*, *Triglochin palustris*, *Listera cordata*, *Armeria maritima*, *Poa alpina*, *Carex saxatilis* and by the other of both large and small forms of *Dryopteris dilatata*.

Wednesday was fine and was spent exploring woodlands along Glen Lyon; two of the party went further to an alpine site on Meall Ghaordie where *Salix myrsinites* was seen. The first stop was at Fortingall with its famous churchyard yew said to be 3000 years old; the churchyard wall provided our first *Asplenium adiantum-nigrum* of the day. Reaching the Glen we stopped at Macgregor's Leap where the river falls through a narrow gorge; 12 ferns and 2 horsetails were found. Six localities were visited along the Glen in one of which *Dryopteris abbreviata* was found. At Carnbane Castle Malefern and Ladyfern were growing vigorously and with variation and *Corydalis claviculata* was seen. On returning to Aberfeldy we stopped to inspect the Tay Bridge built in 1733 by General Wade as part of his military road through the highlands; *Asplenium ruta-muraria* and *A. trichomanes* beautify the bridge and also the rugged stone pedestal of the nearby Black Watch monument.

On Thursday we were joined by a local member, Mrs M. R. Stuart. As the day boded fine it was decided to tackle Ben Lawers itself. Most of the mountain and the area on the Loch Tay side is protected by the National Trust for Scotland who have produced an excellent account entitled *Ben Lawers and its alpine flowers*. The route taken, up the Lawers Burn, was long and only the two youngest reached the summit; the first half mile runs through a wooded gorge; taking the path above this we soon saw *Parnassia palustris* and *Drosera rotundifolia*. On reaching the National Trust boundary the woods ceased and a long bare valley stretched ahead with few ferns except *Thelypteris limbosperma*. At the head of this valley is a small dam and from there to Lochan nan Cat is a boggy heath where were Whortleberry and Crowberry, laden with ripe fruit, Cottongrass and other marsh plants. Lochan nan Cat lies at 2300 feet and is surrounded on three sides by a vast amphitheatre of cliffs rising a further 1000 feet and more; these cliffs were our main objective; alpine plants abounded, Hollyfern flourished, but we failed to find *Woodsia alpina*. On returning to the main road tea was taken at the Lawers Hotel which has catered for generations of botanists and has interesting mementos of some of the most famous; *Urtica urens* was recorded right outside the hotel. In the evening, thanks to a local enthusiast and to the local Camera Club in loaning a projector, we had a

show of lanternslides including fern propagation by Bert Bruty, botanising in Austria and Greece by Anne Sleep and Irish High Crosses by Maura Scannell.

Friday was mainly wet and we went further afield to Glen Clova. From the youth hostel at the head of the glen we were permitted to take the Forestry Commission road up to the foot of the Fee Burn but, in spite of this time-saving, only an hour-and-a-half was left to explore cliffs and loose screes; 13 fern species were found, including *Athyrium distentifolium* and *Dryopteris abbreviata*. On the way back *Polypodium interjectum* was collected by the roadside. Before joining us, Mrs Stuart had found Hart'stonguefern on a wall near Pitlochry.

On Saturday, the day of farewells and departures, the minibus party for the South decided to detour through Aberdeen to see *Cystopteris dickieana* still growing happily in its type-locality.

This was the first major excursion of the Society since the publication of the *Atlas of the British flora* to which we provided 13 unpublished records (7 ferns, 2 fern allies, 4 flowering plants). For another society we recorded frogs and toads, which were frequently encountered. In spite of intensive search in known stations we failed to find *Woodsia* or *Cystopteris montana*. A list is appended of the 23 ferns and 8 fern allies which were found; the numbers refer to localities, details of which follow.

V.C. 88 Mid Perth (*O.S. 1" map, ser. 7, sheet 47*)	Date visited September	National Grid Ref. 27/
1 MEALL NA SAMHNA, 10 miles W of Tyndrum	11	4833, 4933
2 ALLT DUBHCHLAIR, 10 miles N of Tyndrum	11	5034
3 MEALL GHAORDIE, 12 miles NE of Tyndrum	12	5141
(*O.S. sheet 48*)		
4 Slopes on the W side of LOCHAN NA LAIRIGE, 5 miles N of Killin	10	5939
5 Around GALLIN, Glen Lyon	12	5345, 5445
6 INNERWICK, Glen Lyon	12	5847
7 LOCHAN NAN CAT area, Ben Lawers ...	13	6442, 6542
8 LAWERS BURN, Ben Lawers	13	6741, 6742
9 LAWERS BURN, lower wooded area	13	6740
10 INVERVAR, Glen Lyon	12	6648
11 CARNBANE CASTLE, Glen Lyon	12	6748
12 MACGREGOR'S LEAP, Glen Lyon	12	7247
13 FORTINGALL, 7 miles W of Aberfeldy ...	12	7447
14 BIRKS OF ABERFELDY	9	8547, 8548
15 ABERFELDY	9 - 15	8548, 8549
V.C. 89 East Perth (*O.S. sheet 49*)		
16 MOULIN, near Pitlochry	14	9459 37/
17 By A.923 road, 3 miles E of Blairgowrie	14	1244
V.C. 90 Angus (Forfar) (*O.S. sheet 41*)		
18 FEE BURN corrie, Glen Clova	14	2574

Lycopodium selago — 1, 4, 7, 8, 13, 18
L. clavatum — 1, 4, 7, 8, 13
L. alpinum — 1, 4, 8, 13
Selaginella selaginoides — 1, 4, 8, 13, 18
Equisetum fluviatile — 4
E. palustre — 1, 8
E. arvense — 8, 12
Pteridium aquilinum — 2, 3, 5, 6, 8, 9, 10, 12, 14
Blechnum spicant — 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 18
Phyllitis scolopendrium — 14, 16
Asplenium adiantum-nigrum — 11, 12, 13
A. trichomanes — 4, 6, 10, 11, 12, 14
A. viride — 1, 2, 3, 4, 14, 18
A. ruta-muraria — 10, 11, 13, 15
Athyrium filix-femina — 1, 5, 6, 9, 10, 11, 12, 14, 15, 18
A. distentifolium — 18
Cystopteris dickieana — type locality
C. fragilis — 1, 2, 3, 4, 8, 9, 12, 14, 15, 18
Dryopteris filix-mas — 1, 4, 6, 9, 10, 11, 12, 13, 14, 15, 18
D. borreri — 2, 5, 8, 9, 10, 11, 12, 14, 18
D. abbreviata — 10, 18
D. assimilis? — 7, 18
D. dilatata — 1, 3, 4, 5, 7, 8, 9, 10, 11, 13, 14, 18
Polystichum aculeatum — 4, 9, 12, 14
P. lonchitis — 1, 3, 4, 7, 18
Thelypteris limbosperma — 1, 2, 4, 5, 6, 7, 8, 10, 12, 14, 18
T. phegopteris — 1, 2, 3, 4, 7, 9, 12, 14, 18
Gymnocarpium dryopteris — 1, 2, 3, 5, 14, 18
Polypodium vulgare — 1, 2, 4, 7, 8, 9, 10, 11, 12, 14
P. interjectum — 17
Botrychium lunaria — 15

ANNUAL GENERAL MEETING, 22 September, at the British Museum (Natural History), London. A report has already been circulated and the financial statement will appear in a *Newsletter*. After business had concluded, Professor Holttum spoke on treeferns; we hope a presidential address may become a custom.

TUNBRIDGE WELLS, Kent, 23 September. Four people had a good day's botanising around Frant and Eridge Park. 12 fern species were found, the outstanding ones being *Dryopteris aemula* (one plant) and *Hymenophyllum tunbrigense* (several colonies, one of them extensive and luxuriant).

ROBERT WHITESIDE

Robert Whiteside [1] who died in November 1960 aged 94 was one of the founders of the Northern British Pteridological Society constituted in Lakeland in 1891 [2]. In his late teens he was handed his father's garden at Lancaster to look after and being anxious to have ferns in it he visited the

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[1] Autobiographic details in *British Fern Gazette* 7:227-230 (1949).

[2] There was a British Pteridological Society holding meetings in Kent in the 1870s but it presumably became defunct. One of its members (G. B. Wollaston) joined the 1891 Society.

fern enthusiasts at Kendal, Bowness-on-Windermere and Warton. As a result of these contacts he suggested a meeting at Kendal with the object of forming a society and he was deputed to communicate with anyone likely to be interested. Ten people [3] attended this meeting in 1891 and Dr F. W. Stansfield was asked to be President. In 1892 " Northern " was dropped from the title of the Society which soon became a focal point for fern enthusiasts throughout the British Isles.

Whiteside in his younger days had great physical energy and he led a busy life; he owned and managed a laundry at Lancaster, took part in local affairs and was several times president of the local horticultural society. A serious heart attack in 1941 led to his retirement from business and his moving house to Morecambe whence he had an uninterrupted view across the bay of some of the Lake District mountains he knew so well.

I gratefully acknowledge Whiteside's strong support given to me and to the Society when I had to take over the Secretaryship in disturbed conditions on the death of Dr Stansfield in 1937.

P. GREENFIELD

SPORE AND PLANT EXCHANGE

AMERICAN FERN SOCIETY. Neill D. Hall, 1225 East 95 Street, Seattle 15, Washington, U.S.A. has been appointed National Director of the Spore Exchange of the American Fern Society which invites botanic gardens, universities and individuals throughout the world to participate. The current list of available spores includes many rare and choice ferns. Our Secretary (J. W. Dyce) will be pleased to supply a copy of this list to anyone interested.

UNIVERSITY OF HULL. The Department of Botany, The University, Hull, Yorkshire offers seeds and spores for exchange.

UNIVERSITY OF MALAYA. Edmund A. Turnau, Department of Botany, University of Malaya, Pantai Valley, Kuala Lumpur, Malaya will be happy to supply local material to those interested in the ferns of Malaya.

STUART L. WILLIAMS, 664 Rochester Way, Eltham Park, London SE9 would like spores of the Japanese hardy form of *Adiantum flabellulatum* (syn. *A. amoenum*).

---

[3] T. Bolton, J. Garnett, J. Gott, J. J. Smithies, J. Stewardson, R. Whiteside, G. Whitwell, J. A. Wilson, W. Wilson, J. Wiper.

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DRYOPTERIS ASSIMILIS S.WALKER IN BRITAIN

S. WALKER and A. C. JERMY

Dept. of Genetics, University of Liverpool *British Museum (Natural History)*

The second edition of the British Flora (Clapham, Tutin and Warburg, 1962) contains the description of a species of *Dryopteris* (viz. *Dryopteris assimilis* S. Walker) that may on first sight be new to many British botanists. It is however the description of a plant known to fern enthusiasts as *Dryopteris dilatata* var. *alpina*, first described under *Lastrea* by Thomas Moore in 1856 from specimens he had collected on Ben Lawers, Perthshire, a year earlier. These specimens Moore placed in his Herbarium (now at the Royal Botanic Gardens, Kew) on three sheets labelled in his hand " *Ben Lawers, Perthshire 1855 T.M.*"; a photograph of one of these sheets is shown on PLATE I. A typical mature frond from one of these sheets has been designated lectotype by one of us (A.C.J.); a silhouette of that frond, and a drawing of a spore from it is shown in FIG. 1a & b.

In the course of a cytogenetic investigation of the *Dryopteris spinulosa* complex in Europe, the results of which are published elsewhere[1], *Dryopteris dilatata* var. *alpina* from Ben Lawers (see FIG. 1c) was examined and found to be a diploid (2n=82). Furthermore, artificial hybridisation and the study of chromosome pairing at meiosis showed this diploid to be one of the parents of the allotetraploid *D. dilatata* var. *dilatata*, the more common form. A frond silhouette and a drawing of the spore of the tetraploid is shown in FIG. 2. It will be seen that the basal pinnule on the lowermost pinna is shorter in proportion to the length of that pinna than the corresponding pinnule of *assimilis* (cf. FIG. 1c). The difference in spore outer-wall morphology between diploid and tetraploid *D. dilatata* agg. was pointed out by Fern Ward Crane[2]; those of the tetraploid (*D. dilatata* sensu stricto) appear darker in colour because of the thicker and denser spinules. Hybrids between the two cytotypes are sterile. Because of these findings it was decided to treat the diploid as a separate species and the name *D. assimilis* was given to the plant originally called *Lastrea dilatata* var. *alpina* by Moore. The description (with diagnostic characters in *italics*) that follows enlarges upon that given by Moore:

---

[1] WALKER, S., 1955, *Watsonia* 3: 193-209.

[2] CRANE, F. W., 1955, *Watsonia* 3: 168-9.

The BRITISH FERN GAZETTE Vol. 9 Part 4 (pp. 97-135) was published 26 September 1963.

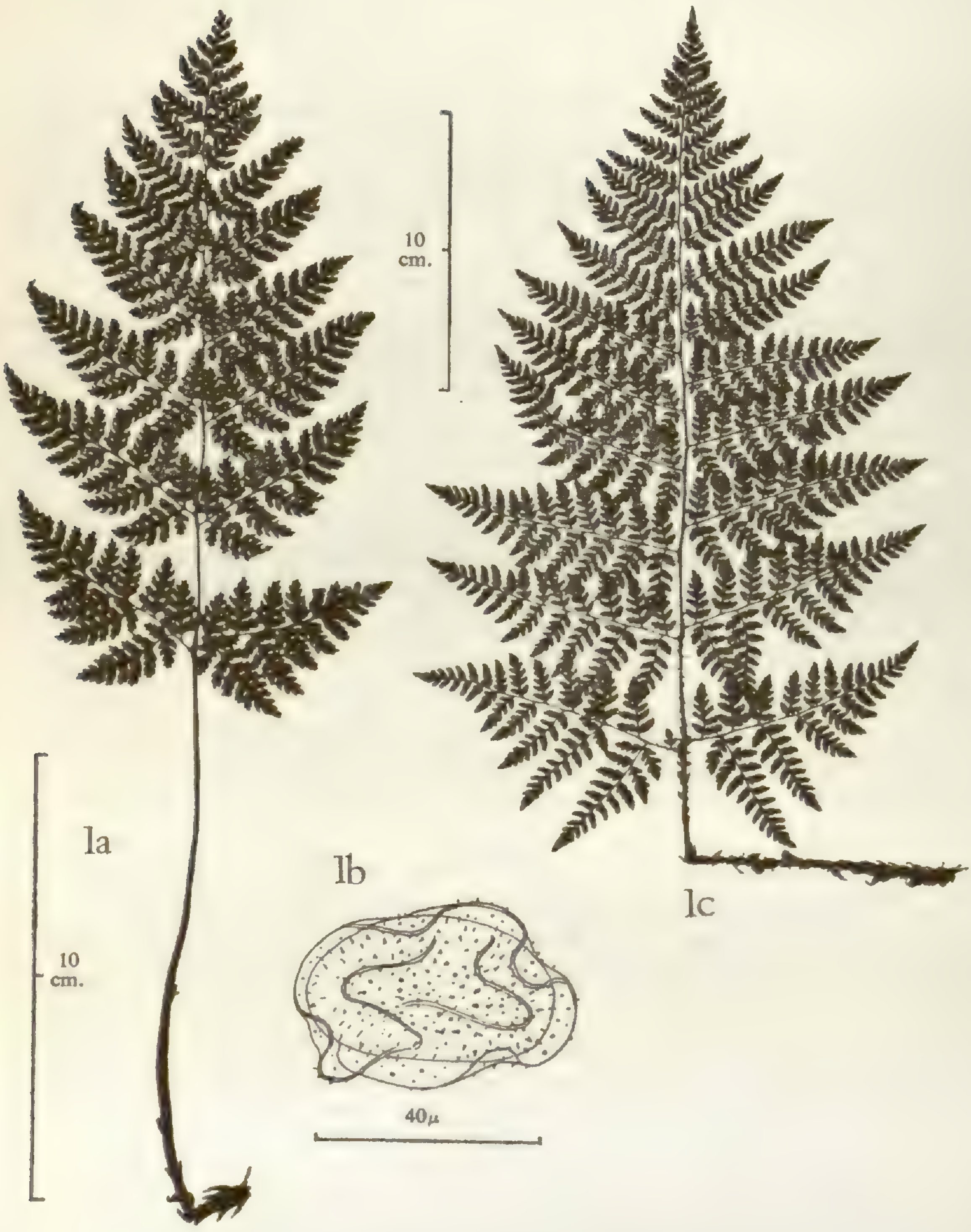

FIGURE 1 *Dryopteris assimilis* S.WALKER
1a, b: Lectotype; 1c: Cytologically determined material from Ben Lawer

PLATE I *Drypteris assimilis* S. WALKER Type Coll. Hb. Kew

Dryopteris assimilis S. Walker, in *Amer.Journ.Bot.* **48**:607, footnote (9 Aug. 1961).

Lastrea dilatata var. *alpina* T. Moore, *Nature Printed Ferns of Great Britain and Ireland*, sub tab. 22 (sine figura) (1856); *Handbook Brit. Ferns* 3rd ed.:126 (1857); *Nature Printed Brit. Ferns:* 225 (sine fig.) (1859).

Lectotype and syntypes, Ben Lawers, 1855, *T. Moore* (K). Rhizome short, erect or ascending, often with several crowns. Fronds 7–60cm long; stipe pale brown darkening only at the base, scaly below, *scales* ovate-subdeltate *abruptly accuminate into long*, *often falcate*, *apex* $\frac{1}{5}-\frac{1}{3}$ *of total length*, *light brown* usually with well-defined dark brown central stripe; *blade* 1–1$\frac{1}{2}$ times length of stipe, *light green*, thin, linear-lanceolate, often almost parallel-sided below, apex acute, bi-tripinnate; *pinnae* narrowly triangular to linear, *the lowermost one having a markedly longer basal pinnule on the lower side which is about half as long as that pinna; pinnules finely pinnatisect*, with mucronate teeth. Sori situated in two rows near the pinnule midrib, c. 1mm in diam., with small indusia which are glandular on the margin and soon becoming evanescent. *Spores* 45–50μ × 30–37μ, with thin pale brown perispore with a few narrow wings and *widely spaced acute spinnules up to 1μ in length* (cf. FIGS. 1b & 2b).

Whilst Ben Lawers is the only locality from which material has been cytologically examined, a morphological investigation of herbarium material at the British Museum (BM) and Kew (K) revealed the following other probable localities for *D. assimilis:*

v–c	65–66	"Teesdale", *Mitchinson*, 1860, Herb. T. Moore (K)
v–c	70	Cumberland, Keswick, *Wright*, 1859, Herb. T. Moore (K)
v–c	72	Dumfries, Hart Fell, *P. N. Fraser*, 1861, Herb. T. Moore (K)
v–c	88	Mid-Perth, Killin, *E. Liddell*, 1871, Herb. T. Moore (K)
v–c	92	S. Aberdeen, Glen Callater, *A. Croall*, 1855, Herb. T. Moore (K)
v–c	98	Argyll, Oban, *D. Clarke*, 1864, Herb. T. Moore (K)
v–c	100	Clyde Isles, Arran, *E. Greatorex* 1861, Herb. T. Moore (K)

Other material which was immature, but which on scale and frond characters may possibly be *D. assimilis* came from:

v–c	88	Mid Perth, Aberfeldy, *E. C. Tollemache*, 1870 (K)
v–c	89	E. Perth, Glen Beg, *T. J. Foggitt*, 15.7.1908 (BM)
v–c	99	Dunbarton, Ben Voirlich, *Balfour*, 1845; (BM)
v–c	104	N. Ebudes, Hallaig, Raasay, *M. McCallum Webster*, 20.6.1957 (BM)

Plants from all these localities require further investigation and we should be pleased to receive material from any botanist who visits them. Living specimens are best sent with the rhizome wrapped in polythene together with damp moss. If, however, the number of plants in the locality is small, only pressed fronds, preferably fertile with mature spores, should be sent.

Mr H. V. Corley has provided some interesting plants from a number of localities in the country and has so far revealed a diploid in at least one new locality. Following up reports from Mr Corley, one of us (S.W.) has recently

FIGURE 2 *Dryopteris dilatata* (Hoffm.) A. Gray Tetraploid plant from Bowland Knotts, Yorks.

visited areas in Ross-shire, Argyll-shire and Perthshire and sampled a number of populations. Plants have been brought back for further study.

An initial reaction to a more concentrated search for the diploid *D. assimilis* is that it may be more variable in morphology than at first thought. This is of course the situation found in tetraploid *D. dilatata* where variation is extreme in different habitats and often within the same population. The diagnostic and especially the spore characters of *D. assimilis* are seen in other varieties of *Lastrea* (*Dryopteris*) *dilatata* described or determined by Moore and now in his herbarium (viz. *ornamentata*, *lawersensis* and *micromera*) and it is possible that these may prove to be variations within *assimilis*.

The re-discovery of these plants in the wild and their subsequent cytological examination can be the only answer.

We should like to thank the Director of the Royal Botanic Gardens, Kew, for allowing us to examine the Moore specimens.

A DIPLOID FORM OF *ASPLENIUM RUTA-MURARIA*

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T. REICHSTEIN
Institut für organische Chemie der Universität, Basel

In the last issue of this journal[1], an account was given of meiosis in the example of *Asplenium* × *murbeckii* found by F. Jackson on Castle Crag, Borrowdale[2]. *A.* × *murbeckii* Dörfler is the hybrid between *A. ruta-muraria* L. and *A. septentrionale* (L.) Hoffman. At the time that note was written, only tetraploid chromosome numbers were known for either *A. ruta-muraria* or *A. septentrionale* in any part of their geographical ranges[3]. An unexpectedly high degree of chromosome pairing was found in the Castle Crag hybrid, and the possibility was considered that all the bivalents present were in fact produced by autosyndesis, in other words, that the bivalents formed in this hybrid are all produced by chromosome pairing between genomes contributed by the same parent, and not by pairing of chromosomes contributed by different parents. If this were true, it would imply that diploid forms referable to *A. ruta-muraria* and *A. septentrionale* have almost certainly existed in the past and might indeed still be living today. Most remarkably, as has already been briefly reported elsewhere[4], in rapid succession diploid forms of these two species have now been discovered.

The diploid form of *Asplenium septentrionale* is known at present only from the Caucasus, and has not yet been studied so sufficiently as to justify taxonomic description at this time. No specimens of this plant have yet been detected from the area of Europe as defined for the purposes of *Flora Europaea*.

The probable existence of an extant diploid form of *Asplenium ruta-muraria* became evident to us after a putative hybrid between *A. lepidum* C. Presl (another tetraploid species[5], [6]) and *A. ruta-muraria* detected by one of us (T.R.), in the possession of Herr Th. Egli of Canton Zurich, had proved to be triploid and not tetraploid, as is usual for this hybrid[5]. This plant had originally been collected by Herr Egli from the Buco di Vela near Trento in N Italy, and subsequent cytological examination of a specimen of

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[1] LOVIS, J. D., 1963, *Brit. Fern Gaz.* 9:110.
[2] JACKSON, F., 1961, *Brit. Fern Gaz.* 9:49
[3] MANTON, I, 1950, *Problems of Cytology and Evolution in the Pteridophyta;* MEYER, D. E., 1957, *Ber.Deutsch.Bot.Ges.*, 70:57; WAGNER, W. H., Jr., 1955, *Rhodora* 57:219 (*A. ruta-muraria*, U.S.A., n=72); BIR, S. S., in MEHRA, P.H., 1961, *Res.Bull.Panjab Univ., n.s.*, 12:139 (*A. septentrionale*, Himalaya, n=72).
LOVIS, J. D. 1964, *Nature*, in press.
LOVIS, J. D., and REICHSTEIN, T., unpublished.
[4] MEYER, D. E., 1959, *Ber.Deutsch.Bot.Ges.* 72;37; 1964, *ibid.* 77:3.

A. ruta-muraria from this locality already in cultivation in Basel showed this to be diploid. Since then we have found diploid plants of *A. ruta-muraria in situ* in the Buco di Vela, and in other localities in the Italian Dolomites. At present, this plant is not known outside the Italian Dolomites, although it is quite evident that within this region it is rather common, and indeed appears to be there the prevalent form of *A. ruta-muraria*, at least on native rock. The diploid form of *Asplenium ruta-muraria* is described below as a distinct subspecies (*dolomiticum*).

MORPHOLOGICAL COMPARISON OF THE SUBSPECIES OF ASPLENIUM RUTA-MURARIA

1 MACRO-CHARACTERS It is not easy to distinguish the diploid subsp. *dolomiticum* from the tetraploid subsp. *ruta-muraria* on the basis of macro-characters alone. In both subspecies the shape of the pinnules is extremely variable, although those of *dolomiticum* are usually smaller and more regular in shape. The pinnules of the latter are certainly more delicate and thin in texture, and the rhachis and stipe are usually less stout than in *ruta-muraria*. However, the most striking macro-character lies in the margin of the pinnules. In living plants of *dolomiticum* the colourless margin of the pinnules is very obvious. This clear border is of uneven width, being widest on the irregular teeth at the tips of the pinnules, making these teeth relatively conspicuous.

The rhizome scales do not provide a reliable character, being peculiarly inconsistent in both subspecies. Many collections of *ruta-muraria* possess markedly larger scales than those of any of the collections of *dolomiticum* yet examined, but in some collections of both subspecies the rhizome scales are quite minute and difficult to examine.

2 MICRO-CHARACTERS Under the microscope, the two subspecies may be distinguished with relative ease by examination of either spores or stomata. In both subspecies the length/breadth ratio of the stomata is variable, the stomata being longer in etiolated fronds produced in deep shade conditions. Consideration of stomatal length alone is consequently inadequate to distinguish shade forms of subsp. *dolomiticum* from exposed forms of subsp. *ruta-muraria*. In such circumstances there is, however, a marked difference in the breadth of the stomata, sufficient to distinguish the two subspecies.

The figures obtained from measurements of stomata and spores are given below; in each case, fifty spores or stomata were measured. Stomata were measured in water, the pinnae having first been cleared with a hypochlorite agent. The figures given for spore size are from spores mounted in De Faure's gum chloral. Only the exospore was measured, the perispore being ignored. All the measurements given are obtained from material of known chromosome number. Since the number of cytologically known samples at present available is very limited, it will be evident that the ranges of size for the two subspecies derived from these measurements may eventually

PLATE II Holotype of *Asplenium ruta-muraria* subsp. *dolomiticum* in situ in shaded crevice of perpendicular dolomite rock wall in Val di Uda above Mazzin, E of Bolzano, N Italy. *Photo:* JDL10.9.1963.

require amendment when more cytologically determined material has been examined.

TYPIFICATION OF ASPLENIUM RUTA-MURARIA L. AND DESCRIPTIONS OF SUBSPECIES Although the question of the typification of *Asplenium ruta-muraria* L. has not been investigated in detail, it does not appear to present the same difficulty as the case of *Asplenium trichomanes* L.[7]. It is already evident that the diploid subspecies of *A. ruta-muraria* is very much rarer and more local in distribution than the tetraploid. Very probably only the tetraploid is found in Sweden. Consequently, in the absence of any contrary evidence, it is a reasonable assumption that it is the tetraploid plant with which Linnaeus would have been familiar, and which therefore best deserves to be regarded as the type subspecies.

Asplenium ruta-muraria L., Sp.Plant. 2:1081 (1753), subsp. *ruta-muraria.*

Fronds relatively robust; *rhachis* comparatively stout; *pinnules* variable in shape, but usually somewhat more angular, texture relatively thick, colourless margin rarely conspicuous. *Stomata* 37–66μ long (range of means 50–57μ), 31–46μ broad (range of means 35–42μ). *Spores* (size of exospore only in chloral medium) 41–60μ long (range of means 49–54μ), 33–46μ broad (range of means 37–42μ). *Chromosome number* n=72, 2n=144. *Habitat* in fissures of basic rocks throughout Europe. Also in North America and Asia.

Asplenium ruta-muraria L. subsp. **dolomiticum** Lovis & Reichstein **subsp.nov.** (vide figs. 1–9 et tab. 2).

Frondes delicatae, rhachibus gracilibus; *pinnulae* plerumque constanter rotundis-rhomboidis, texturae tenues, marginis cum conspicuibus pellucidibus cicatricibus membranibus limbibus. *Stomata* 35–56μ longae (ordo mediis 41–49μ), 27–38μ latae (ordo mediis 30–34μ)*. *Sporae* (magnitudo exospori solum in humore chlorale), 33–54μ longae (ordo mediis 39–46μ), 25–42μ latae (ordo mediis 29–39μ)†. *Chromosomata* gametophyti 36, sporophyti 72.

Holotype: N ITALY, Trentino Alto Adige: Val di Uda, above and ca. 1km NW of Mazzin (Val di Fassa), 25km ESE of Bolzano, ca. 1850m in crevices of shaded perpendicular dolomitic rock, *E. Hauser, J. D. Lovis & T. Reichstein JDL1963:87T*, 10 Sept. 1963. Holotype plant (PL. II & FIGS. 7–9) divided, one half deposited in the herbarium of the British Museum (Nat. Hist.), other half in cultivation in T. Reichstein's garden in Basel, sub TR950.

Paratypes: N ITALY, Trentino Alto Adige: Buco di Vela, ca. 3km W of Trento, ca. 450m on dolomitic rock, *Reichstein TR19*, summer 1956, cult. in

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[7] LOVIS, J. D., 1964, *Brit. Fern Gaz.* 9: 147.

* Holotype 37·5-55·5μ (mean 46·1) long, 29·5-37·5μ (mean 32·4μ) broad.

† Holotype 39·5-53·5μ (mean 45·6μ) long, 31·5-41·5μ (mean 38·6μ) broad.

Basel; ca. 410m on same rock, *Hauser, Lovis & Reichstein JDL1963:97, TR965*, 11 Sept. 1963; Val d'Adige ca. 3km SW of Salorno, ENE of Trento, ca. 230m on dolomitic rock-wall, *Hauser, Lovis & Reichstein JDL1963:91, TR963, 964*, 11 Sept. 1963; Monte Bondone, ca. 5km SW of Trento, ca. 1700m on dolomitic rock *Hauser, Lovis & Reichstein JDL1963:99, TR966*, 11 Sept. 1963. N ITALY, Venezia Giulia: N of Chiusaforte, Canale del Ferro N of Udine ca. 450m on dolomitic rock, *Lovis & Reichstein JDL1963:83, TR944*, 9 Sept. 1963.

Fronds delicate, with a slender rhachis; *pinnules* usually regularly round-rhombic, texture thin, margin with conspicuous colourless membraneous border. *Stomata* 35–56μ long (range of means 41–49μ), 27–38μ broad (range of means 30–34μ). *Spores* (size of exospore only in chloral medium), 33–54μ long (range of means 39–46μ), 25–42μ broad (range of means 29–39μ). *Chromosome number* n=36, 2n=72. *Habitat* in fissures of dolomitic rock in N Italy.

TABLE I SPORE MEASUREMENTS

	Range		Mean
subsp. *dolomiticum*	Length μ	Breadth μ	L × B
Mazzin, E of Bolzano, N Italy (TYPUS)	39·5–53·5	31·5–41·5	*45·6 × 38·6*
nr. Salorno, N of Trento, N Italy ...	33·5–47·5	29·5–37·5	*41·0 × 33·1*
nr. Chiusaforte, N of Udine, N Italy ...	37·5–45·5	29·5–35·5	*41·7 × 32·3*
Buco di Vela, nr. Trento, N Italy ...	33·5–45·5	25·5–33·5	*39·7 × 29·7*
	33 – 54μ	25 – 42μ	*39–46 × 29–39*
subsp. *ruta-muraria*			
Chapel-le-Dale, Yorkshire, England ...	49·5–59·5	37·5–43·5	*53·3 × 41·3*
Kraubath, Steiermark, Austria ...	41·5–57·5	33·5–45·5	*49·4 × 37·4*
Convento Bigorio, Tessin, Switzerland	41·5–57·5	33·5–41·5	*49·5 × 37·3*
Hutton Roof, Westmorland, England ...	45·5–55·5	37·5–41·5	*50·7 × 39·4*
nr. Varese, NW of Milan, N Italy ...	...	...	...
	41 – 60μ	33 – 46μ	*49–54 × 37–42*

TABLE II STOMA MEASUREMENTS

	Range		Mean
subsp. *dolomiticum*	Length μ	Breadth μ	L × B
Mazzin, E of Bolzano, N Italy (TYPUS)	37·5–55·5	29·5–37·5	*46·1 × 32·4*
nr. Salorno, N of Trento, N Italy ...	37·5–49·5	29·5–35·5	*41·9 × 33·2*
nr. Chiusaforte, N of Udine, N Italy ...	37·5–53·5	27·5–33·5	*48·2 × 30·9*
Buco di Vela, nr. Trento, N Italy ...	33·5–53·5	29·5–37·5	*47·7 × 33·9*
	35 – 56μ	27 – 38μ	*41–49 × 30–34*
subsp. *ruta-muraria*			
Chapel-le-Dale, Yorkshire, England ...	51·5–65·5	33·5–43·5	*56·9 × 39·3*
Kraubath, Steiermark, Austria ...	41·5–59·5	35·5–45·5	*53·2 × 41·1*
Convento Bigorio, Tessin, Switzerland	41·5–59·5	31·5–39·5	*54·2 × 35·4*
Hutton Roof, Westmorland, England ...	...	...	...
nr. Varese, NW of Milan, N Italy ...	37·5–61·5	33·5–43·5	*50·8 × 39·8*
	37 – 66μ	31 – 46μ	*50–57 × 35–42*

FIGS. 1-9 Photo-copy silhouettes (reproduced natural size) of fertile fronds of *Asplenium ruta-muraria* subsp. *dolomiticum*, all pressed from wild material. FIG. 1 nr. Chiusaforte, N of Udine. FIGS. 2, 3, 4 and 5 Buco di Vela, nr. Trento. FIG. 6 Monte Bondone, SW of Trento. FIGS. 7, 8 and 9 HOLOTYPE, Hauser, Lovis and Reichstein JDL1963:87T.

FIGURES 1 - 9

SYNONYMY Correlation of *Asplenium ruta-muraria* ssp. *dolomiticum* and the numerous minor taxa already described within *A. ruta-muraria* is a very difficult task, one which will require much more investigation. Because of the uncertainties that remain unresolved, no attempt is made here to indicate synonymy. Thus, it is very likely that one or more of the varieties recognised by Christ[8], may refer to subsp. *dolomiticum*, but without reference to Christ's herbarium, which at present remains inaccessible, any attributions not based on very careful study would be open to question.

Asplenium ruta-muraria is divided into three subspecies by Grintescu in Savulesci's flora of Roumania[9]. One of these, subsp. *typicum*, by application of Articles 24 and 26 of the current *International Code of Botanical Nomenclature*, should be more correctly known as subsp. *ruta-muraria*. No specimens or illustrations have been seen, but from the descriptions given, it is clearly extremely improbable that either of his two new subspecies, subsp. *ponticum* Grintescu, and subsp. *grammitioides* Grintescu, corresponds to subsp. *dolomiticum*. In the case of subsp. *ponticum*, *A. haussknechtii* God. & Reut. is cited in synonymy. Unless this attribution is entirely erroneous, it is most interesting, for *A. haussknechtii* is a rather obscure taxon described from Asian Turkey, certainly quite distinct from *A. ruta-muraria*, but very close to *A. samarcandense* Koss. and having some affinity with *A. lepidum* C. Presl. If *A. haussknechtii* is really concerned, then we have here an indication of an addition to the *Asplenium* flora of Europe. What is perhaps more likely is that the Roumanian plant really refers to *A. lepidum*, not recognised for itself. It is relevant to note that *A. lepidum* has only very recently been detected in Hungary[10], and thus might well grow unrecognised in Roumania.

THE RELATIONSHIP OF THE SUBSPECIES OF ASPLENIUM RUTA-MURARIA The nature of the cytogenetic relationship between the two subspecies of *Asplenium ruta-muraria* recognised in this paper is a subject of obvious interest and is now under active investigation.

It is a great pleasure to record here our grateful thanks to Professor I. Manton, for her advice and encouragement. We also thank Herr Egli for his kind co-operation.

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[8] CHRIST, H., 1903, *Hedwigia* 42:153.
[9] GRINTESCU, G., in SAVULESCI, T., 1952, *Flor.Repub.Popul.Romane* 1 *Add.*: 634.
[10] VIDA, G., 1963, *Acta Bot.Acad.Sci.Hung.* 9:214.

THE TAXONOMY OF *ASPLENIUM TRICHOMANES* IN EUROPE

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The existence of a species complex within *Asplenium trichomanes* L. has been known ever since the publication in 1950 of Manton's *magnum opus*[1] on the cytology of the pteridophyta, in which the discovery of diploid and tetraploid chromosome numbers in European *A. trichomanes* is described. For the last ten years, I have been engaged on an intensive biosystematic study of the complex, a study which is far from complete, and is still in progress.

Preparation of the account of *Asplenium* for *Flora Europaea* made it very desirable that an adequate taxonomic treatment of the complex be formulated, representing as accurately as possible our present state of knowledge of this complex as found in Europe.

In 1962 Meyer[2] described the two European cytotypes (diploid and tetraploid), as distinct subspecies, and this treatment has been followed in the *Flora*, as being consistent with the concept of subspecies as generally applied therein. However, some amendments of Meyer's nomenclature and diagnoses are required, and are given in this paper. Very recently, too recently for inclusion within *Flora Europaea*, another diploid taxon within *Asplenium trichomanes* has been discovered in Europe. In direct contrast to the strictly calcifuge character of the more familiar diploid, which is particularly frequent in central and northern Europe, the new taxon appears to be confined to limestone in central and south-eastern Europe. This plant is described below as a new subspecies.

In the final section of this paper the confused situation resulting from the recent publication of three new specific names within the *Asplenium trichomanes* complex is discussed.

THE TYPIFICATION OF ASPLENIUM TRICHOMANES L.

In describing the two cytotypes found in Europe as distinct subspecies, Meyer[2] circumvented the very difficult problem of the typification of *Asplenium trichomanes* L. by the expedient of giving new names to both subspecies, a procedure directly contrary to Article 26 of the International

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[1] MANTON, I., 1950. *Problems of Cytology and Evolution in the Pteridophyta*, Cambridge.

[2] MEYER, D. E., 1962. *Ber. Deutsch. Bot. Ges.* 74:455-6.

Code of Botanical Nomenclature[3]. In so doing, Meyer in effect left the now vexed question of the typification of *A. trichomanes* for subsequent authors to decide, since one of these two subspecies must include the nomenclatural type, and must therefore be regarded as the type subspecies. This subspecies should carry the trivial (specific) epithet in repetition, i.e., it must be called subspecies *trichomanes*.

Already, since the appearance of Meyer's paper, contrary interpretations of the proper application of the name *Asplenium trichomanes* have been published. In the first to appear, Rothmaler's posthumous Flora[4], the diploid plant carried the name *trichomanes*. Rothermaler's untimely death intervened before he was able to publish formal validification of his nomenclature. Subsequently, Fuchs[5] although quoting Rothmaler's names in synonymy, has reversed his decision regarding typification, but without giving any reason for this action. In publishing a new name for the diploid, Fuchs produced a later homonym, and in an addendum to Fuchs' paper (l.c., p.20), Soó (the editor of the journal concerned), provided another name for the diploid, adding the explanatory comment "(*A. trichomanes* auct.p.p. non L. herb.)". As a reason for determining the choice of type subspecies, this statement alone without any elaboration is not acceptable. It is relevant to quote W.T. Stearn, an acknowledged authority on Linnean typification, who writes[6], with reference to the Linnean Herbarium ". . . the specimens present cannot always be accepted as nomenclatural types; indeed it would be highly misleading to accept uncritically a certain specimen in the Linnean Herbarium as a type . . .".

It is not my intention to get involved any further in arguments concerning the typification of *Asplenium trichomanes* L. in this paper. To do so would greatly increase its length, and distract from its main purpose. The typification of *A. trichomanes* is a most complex issue, difficult to resolve. It is my intention to consider this problem and to explain my opinion regarding the typification of this species in a separate paper. For our present purposes I think it is sufficient to state that I base my own interpretation on the guiding principle that where a Linnean name covers a species complex, this name should be retained by that segregate with which Linnaeus would have been most familiar, and which would therefore most likely have represented to

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[3] LANJOUW, J. (edit.), 1961. *International Code of Botanical Nomenclature*, Utrecht.

Meyer's reason for this action was his stated belief that the fern found at the Lapland locality of *A. trichomanes* given by Linnaeus in his *Flora Lapponica* must be the plant we call *A. viride* [" LINNE gab als Standort zur Diagnose für sein *A. trichomanes* eine Gegend an, wo nur *A. viride* vorkommt . . ." (l.c., p.456)]. He does not appear to have realised that the *logical* consequence of his argument would be that our *A. viride* must become *A. trichomanes*, and Maidenhair Spleenwort must take another name! Fortunately, as I shall show elsewhere, there are good reasons for believing Meyer's basic premise to be unjustified.

[4] ROTHMALER, W., 1963. *Exkursionflora von Deutschland*, IV, *Kritischer Erganzungsband*, p.5.

[5] FUCHS, H. P., 1963. *Acta Bot.Acad.Sci.Hungaricae* 9:19-20.

[6] STEARN, W. T., 1961. *Taxon* 10:17.

him the most typical form of his species. In the case of *A. trichomanes*, my investigations have led me to conclude that this would be the familiar diploid taxon widespread in Scandinavia.

THE SUBSPECIES OF ASPLENIUM TRICHOMANES RECOGNISED BY MEYER

Meyer[2] divided *Asplenium trichomanes* L. into two subspecies, subsp. *bivalens* D. E. Meyer, and subsp. *quadrivalens* D. E. Meyer, corresponding to the diploid and tetraploid cytotypes respectively. In order to produce an acceptable taxonomic treatment of Meyer's taxa, it is not sufficient merely to substitute the name *trichomanes* for Meyer's *bivalens*. In his diagnoses and descriptions, Meyer gives only size, sculpture, and colour of spores, chromosome number and ecological preference for each subspecies. Thus, the only characters available from his diagnoses for determination of herbarium material are those of the spores. The qualitative characters of the spores in my experience much too finely balanced and variable to be of practical value. One is left with spore size alone, which will serve to identify positively a considerable proportion of specimens, but there is an inconvenient overlap between the ranges of mean length determinations for diploids and tetraploids[7].

The situation is aggravated by the fact that the ranges of spore size given by Meyer and myself[8] do not agree. The degree of discrepancy is very great, of the order of 30%. I would like to record here my gratitude to Dr Meyer for his co-operation in investigation of this problem. I am most indebted to him for sending me mature fronds from his cultivated type specimens. Without this material it would not have been possible for me to exclude beyond doubt the possibility that the source of the difference lay in the plants themselves.

In the circumstances, I have checked very carefully indeed the calibration of the particular micrometer eyepiece/microscope body/objective combination I use in making my measurements, and satisfied myself of the accuracy of the calibration. Another obvious possible source of discrepancy lies in the medium used in making spore mounts. Measurements were made of spores from the same frond of *Asplenium trichomanes* mounted in different media. The results indicate that spores mounted in gum chloral or in glycerine jelly give measurements of the order of 6% greater than spores mounted dry (i.e., in air), and of the order of 7% greater than spores mounted in pure xylol or in balsam in xylol[9]. My own spore measurements are usually

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[7] LOVIS, J. D., 1958. An evolutionary study of the fern *Asplenium trichomanes*. Ph.D. Thesis, Univ. of Leeds, unpublished.

[8] LOVIS, J. D., 1955. *Bot.Soc.Brit.Isles Conf.Rep.* 4:102.

[9] I was myself surprised to find so large a difference. There has not yet been opportunity to discover whether these differences would be repeated if the spores of other species and genera are investigated but in the light of this experience, it is evidently very desirable that future descriptions of spore size should always indicate the mountant used.

made in De Faure's gum chloral, whereas Dr Meyer has informed me that his measurements were made from dry-mounted spores. A further source of possible discrepancy lies in different selection procedures used in making measurements. I myself, when measuring spores in gum chloral, always ignore spores that are obviously end-ways on or obliquely aligned in the medium. Such a selective procedure is less easy to carry out on spores mounted dry, because of the optical effect of the different refractive indices, and in consequence I determined what difference results from measurement of a sample using the selective procedure described above, as compared with measurements derived from all spores, irrespective of orientation, only misshapen or shrunken spores being excluded. My small pilot experiment indicates a difference in mean of approximately 1·5–3·5%. It is clear that neither difference in medium nor possible difference in selective procedure are adequate to explain the discrepancy between Meyer's results and my own. I can therefore only come to the conclusion that for some other reason Dr Meyer's figures are not characteristic.

The discrepancy between the published figures for spore size given by Meyer and myself is of real practical importance, because Meyer's figures for the length of tetraploid spores correspond more or less to my own figures for the length of *diploid* spores! It is clear that reliance on the figures for spore size given in Meyer's diagnoses can only result in confusion.

It is therefore necessary to provide an amended diagnosis for subsp. *quadrivalens*, and the opportunity is taken to amplify the diagnosis at the same time, since it is in my opinion undesirable to characterise a plant on spore characters and chromosome number alone.

In actual fact, it is usually possible to distinguish subsp. *trichomanes* and subsp. *quadrivalens* without recourse to micro-characters. This is particularly true of living plants, herbarium specimens being admittedly more difficult to determine, especially if of indifferent quality. In subsp. *trichomanes* the pinnae are usually small, suborbicular, distant, and delicate, in contrast to the pinnae of subsp. *quadrivalens*, which are usually larger, oblong, relatively crowded, and more massive except in very shaded situations, when the pinna size and shape alone provide an adequate distinction. The suborbicular form of the pinnae is obscured in luxuriant forms of subsp. *trichomanes* (see TEXT-FIGS. 1:3 and 2:6) by the development of a very characteristic auriculate or subauriculate condition not found in subsp. *quadrivalens*. A further criterion, particularly evident in living plants, is found in the insertion of the upper pinnae, which is always oblique in *trichomanes*, but most often more or less square in *quadrivalens*.

Rhizome scale characters can be useful, but only if applied with care. In both subspecies, the rhizome scales display a wide range of development, and useful comparisons are obtained only if all but the largest scales are ignored. It is then found that the scales of *quadrivalens* are longer, narrower,

TEXT-FIGURE 1 Photo-copy silhouettes (reproduced natural size) of fronds from plants of *Asplenium trichomanes* in cultivation at Leeds. FIGS. 1, 2 and 3 subsp. *trichomanes*, ex Pass of Llanberis, Caernarvonshire, N Wales. FIG. 4 subsp. *quadrivalens*, ex Aber Falls, Caernarvonshire, N Wales. FIG. 5 subsp. *quadrivalens*, ex Beezley Glen, Ingleton, NW Yorkshire, England

with the central stripe of dense cells darker in colour than in subsp. *trichomanes*, and often extending further into the tip of the scale[10].

Asplenium trichomanes L., Sp.Plant.**2**:1080 (1753), subsp. **trichomanes.**

A. melanocaulon Willd., Enum.pl.hort.reg.Berol.:1072 (1809).
A. trichomanes L. subsp. *bivalens* D. E. Meyer in Ber.Deutsch.Bot.Ges. **74**:456 (1962).
A. trichomanes L., emend.Rothm., Exkursionfl.Deutschld. IV, Kritisch. Erganz.:5 (1963).
A. trichomaniforme H. P. Fuchs in Acta Bot.Acad.Sci.Hungaricae **9**:19 (1963) non Woynar (1913).
A. linnaei Soó ex H. P. Fuchs, loc. cit.:20 adnot (1963).

Rhizome scales >3·5mm, lanceolate, with red-brown central stripe. *Fronds* 8–18(–25) cm long, tapering towards apex, apex acute, with (10–) 14–28 pairs of pinnae; *petiole* red-brown, sometimes pale red-brown; *pinnae* 0·25–0·75cm long, suborbicular or more rarely roundly oblong, distinctly auriculate when luxriant, texture delicate, distant, especially towards apex of frond, insertion of upper pinnae oblique, terminal pinna inconspicuous, narrow. *Stomata* 31–52μ long (range of means 38–43μ). *Sori* 4–6(–8) on middle pinnae. *Spores* in chloral medium 23–42μ long (range of means 29–36μ)[11]. *Chromosome number* n=36, 2n=72. On non-calcareous rock in upland regions throughout Europe. Also in North America and Asia. [Melanesia and Australia?]

Asplenium trichomanes L. subsp. **quadrivalens** D. E. Meyer **emend.** Lovis.

A. trichomanes L. subsp. *quadrivalens* D. E. Meyer in Ber.Deutsch.Bot.Ges. **74**:456 (1962) *nomen ambiguum.*
A. lovisii Rothm., Exkursionfl.Deutschld. IV Kritisch.Erganz.: 5 (1963) *nomen nudum.*
A. trichomanes sensu H. P. Fuchs in Acta Bot.Acad.Sci.Hungaricae **9**:20 (1963) non L.

Paleae rhizomati <5mm, linearae-lanceolatae, fuscibus-fulvibus virgibus centralibus. *Frondes* 10–18(–25) cm longae, in forme fastigate sensim erga apice, apices acutae, 16–30 paris pinnis; *stipes* fuscae-fulvae; *pinnae* 0·4–1·2cm longae, oblongae, plerumque lateratae-parallelae, in texturis robustis praeter in habitatis umbrosis, comparatae condensus, insertio pinnis superis quadratus vel pluscula obliquus, pinnis terminalis parum insignis, angustis. *Stomata* 35–57μ longae (ordo mediis 41–49μ). *Sori* (4–) 5–8(–10) ad pinnis mediis. *Sporae* in medio chlorale 27–50μ longae (ordo mediis 34–43μ[12]. *Chromosomata* gametophyti 72, sporophyti 144.

Holotype: GERMANY, Bavaria: Kienberg by Ruhpolding *D. E. Meyer.* Living in culture (Hort. Berol.), as sporophytes Nr. 42, 43, 47 and 82.

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[10] The following quotation is taken from Heywood, V. H., 1960. *Feddes Repertorium* 63:183. "Such an example is found in *Asplenium trichomanes* where the only certain character (and by no means an unambiguous one) to separate the diploid from the tetraploid is the form and details of the rhizome scales (LOVIS)". Although my name is given as authority for this statement, no reference is given, thus denying the reader of the opportunity to check the accuracy of the quotation. I therefore publish this disclaimer here. In actual fact, no information concerning the rhizome scales of *A. trichomanes* has been published by me prior to the present paper.

[11] Type material of *A. trichomanes* subsp. *bivalens* D. E. Meyer (Meyer Nr. 133), gave the following dimensions: in chloral medium, 23·5-35·5μ long (mean 30·5μ), 18·0-27·5μ broad (mean 24·0μ); in air, 22·0-33·5μ long (mean 27·9μ), 18·0-27·5μ broad (mean 22·1μ). 100 spores measured in each medium.

Rhizome scales >5mm, linear-lanceolate, with dark brown central stripe. Fronds 10–18 (–25) cm long, tapering towards apex, apex acute, 16–30 pairs of pinnae; *petiole* dark brown, *pinnae* O·4–1·2cm long, oblong, usually parallel-sided, texture robust except in shaded situations, relatively crowded, insertion of upper pinnae square or somewhat oblique, terminal pinna inconspocuous, narrow. *Stomata* 35–57μ long (range of means 41–49μ). *Sori* (4–) 5–8 (–10) on middle pinnae. *Spores* in chloral medium 27–50μ long (range of means 34–43μ)[12]. *Chromosome number* n=72, 2n=144. In crevices of basic rocks and walls, sometimes on neutral rocks. Throughout Europe, but less frequent in the north. Widely distributed in both northern and southern hemispheres.

THE NEW DIPLOID TAXON WITHIN THE ASPLENIUM TRICHOMANES COMPLEX

It has already been stated above that the diploid subspecies recognised by Meyer, subsp. *bivalens*, found only on non-calcareous rock, and particularly frequent in central and northern Europe, should be called subsp. *trichomanes*. Another diploid taxon is now known, which is apparently confined to limestone rock in central and south-eastern Europe. This plant is described below as subsp. *inexpectans*. In this section the discovery of this plant is briefly described, and the two diploid subspecies are compared.

It was with very great surprise that I discovered that a single plant of *Asplenium trichomanes* collected by J. A. Armitage of the Leeds City Museum in 1961 from limestone near Ston on the Peljesac peninsula on the southern Adriatic coast of Jugoslavia was diploid. My surprise was occasioned both by the morphology and the ecological origin of this plant. The origin from limestone was most unexpected, since although diploid *A. trichomanes* was known from a great variety of rock, including serpentine and mica-schist as well as a considerable number of acidic types, no diploid plants had previously been found on calcareous rock. Moreover, this rule, the absence of diploid *A. trichomanes* from limestone, held good not only in Europe, but also in North America[13], and Australia[7].

Subsequently, another single plant of unusual morphology collected by Miss Anne Sleep of this Department in 1962 from limestone in the Tajgetos mountains of Greece also proved, against prediction, to be diploid.

More recently, some plants of *Asplenium trichomanes* collected by H. Melzer of Judenburg from limestone localities in Austria have proved to be diploid, and in the autumn of 1963 it was possible for me, in company with Professor Melzer and Professor T. Reichstein, to study this plant *in situ* in several localities in Austria.

The familiar diploid form of *Asplenium trichomanes*, subsp. *trichomanes*, is notable not merely for its avoidance of calcareous rock, but also for its

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[12] Type material of *A. trichomanes* subsp. *quadrivalens* D. E. Meyer (Meyer Nr. 47), gave the following dimensions: in chloral medium, 33·5-45·5μ long (mean 39·3μ), 25·5-37·5μ broad (mean 30·7μ); in air 29·5-43·5μ long (mean 38·2μ), 25·5-33·5μ broad (mean 29·6μ). 100 spores measured in each medium. In common with all the other spore measurements given in this paper, these figures refer to the dimensions of the exospore, the perispore being ignored.

[13] BRITTON, D. M., 1953, *Amer.J Bot.* 40:577.

TEXT-FIGURE 2

remarkably constant morphology. As is demonstrated in TEXT FIG. 2: 5 and 6, like all other forms of *A. trichomanes*, subsp. *trichomanes* is very susceptible to modification in size and development by environmental conditions, but this environmental influence is predictable, and this subspecies remains a relatively uniform taxon with a distinctive facies recognisable wherever it is found.

The number of known samples of subsp. *inexpectans* is still very small, but it is nevertheless evident that in direct contrast to subsp. *trichomanes*, *inexpectans* as presently conceived is a very variable taxon. Whether or not the Peljesac plant properly belongs in the same taxon as the Austrian collections is a problem which only more collections and much more study can resolve. Nevertheless, although variable, subsp. *inexpectans* in all its known forms is clearly distinct from subsp. *trichomanes* and merits at least subspecific separation. It will obviously be of great interest to discover what degree of genetic relationship exists between these two taxa, but this can only be determined in due course by experiment.

The most obvious morphological differences between subsp. *trichomanes* and subsp. *inexpectans* lie firstly in the shape of the pinnae, which in *inexpectans* are comparatively square or oblong, not suborbicular, without the distinctive auricle seen in well-grown *trichomanes*, and secondly, in the insertion of the pinnae, which is not oblique in *inexpectans*, but more or less square, even near the tip of the frond. In subsp. *inexpectans* the terminal pinna is usually conspicuous, and the frond ends abruptly, lacking the gradually tapering tip seen in subsp. *trichomanes*.

It is certainly much easier to distinguish subsp. *inexpectans* from subsp. *trichomanes* than it is to distinguish *inexpectans* from some of the forms of subsp. *quadrivalens* found within its geographical range. More than this cannot usefully be stated at the present time, but it is already clear to me that the *Asplenium trichomanes* complex is very much more complex and variable on the forested limestones of central Europe than it is in Great Britain, and a great deal more study is required.

***Asplenium trichomanes* L. subsp. inexpectans Lovis subsp. nov.**

Paleae rhizomati <3·5mm., lanceolatae, rubribus-fulvibus virgibus centralibus. *Frondes* 7·5–10(–12) cm longae, terminales abruptae, apices obtusae, 10–24 paris pinnis; *stipes* fuscae rubrae-fulvae; *pinnae* 0·4–0·8(–1·0) cm longae, quadratae vel oblongae, aliquando angustatae oblongae, plerumque lateratae-parallelae, in texturis delicatis, sub-distantae, insertio pinnis superis quadratus vel parum obliquus,

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TEXT-FIGURE 2 Photo-copy silhouettes (reproduced natural size) of fronds of *Asplenium trichomanes* FIG. 1 from plant in cultivation at Leeds, all others pressed from wild. FIG. 1 subsp. *inexpectans*, ex nr. Ston, Peljesac peninsula, Jugoslavia. FIGS. 2 and 3 subsp. *inexpectans*, Langenbrucke, Gutenstein, Niederösterreich, Austria. FIG. 4 subsp. *trichomanes*, Val d'Antabbia, Canton Ticino, Switzerland (selected as comparable in size to FIG. 3.) FIGS. 5 and 6 subsp. *trichomanes*, Bosco-Gurin, Canton Ticino, Switzerland, demonstrating effect of environment. FIG. 5 from very exposed crevice in serpentine boulder. FIG. 6 from deeply shaded base of other side of same boulder. FIG. 7 subsp. *quadrivalens*, Draycott Rocks, Mendip Hills, Somerset, England, from very deep crevice, with insertion and separation of upper pinnae approaching that of subsp. *trichomanes*. FIG. 8 subsp. *quadrivalens* Bampton N Devon, England, from exposed crevice in mortared wall.

pinna terminalis plerumque manifesta, lata. *Stomata* 31–48μ longae (ordo mediis 40–42μ). *Sori* 4–7(–10) ad pinnis mediis, aliquando condensa in media pinna. *Sporae* 29·5–41·5μ longae (ordo mediis 33–37μ). *Chromosomata* gametophyti 36, sporophyti 72.

Holotype: AUSTRIA, Niederösterreich: at the Langenbrucke, Gutenstein, on shaded limestone rocks, *H. Melzer*, April. 1963, cult. in Basel & Leeds, *JDL1963:150T* in Herb. B.M.

Paratypes (all cytologically determined) AUSTRIA,—Steiermark : Bärenschützklamm, by Mixnitz, *Melzer*, 3 Oct. 1962, cult. in Basel, *TR. 738*, JUGOSLAVIA, Hrvatska: ne Ston, Peljesac peninsula, *J. Armitage*, 17 May 1961, cult. Leeds Univ. *s.n.*. GREECE, Peloponnisos: Taiygetos mountains, in limestone gully, *A. Sleep AS62/29*, 2 Aug. 1962, cult. Leeds Univ. *s.n.*

Rhizome scales <3·5mm, lanceolate, with red-brown central stripe. *Fronds* 7·5–10 (–12) cm. long, abruptly terminated, apex obtuse, 10–24 pairs of pinnae; *petiole* dark red-brown; *pinnae* 0·4–0·8 (–1·0) cm long, square or oblong, sometimes narrowly oblong, usually parallel-sided, texture delicate, sub-distant, insertion of upper pinnae square or slightly oblique, terminal pinna usually conspicuous, broad. *Stomata* 31–48μ long (range of means 40–42μ). *Sori* 4–7 (–10) on middle pinnae, sometimes crowded in middle of pinna. *Spores* 29·5–41·5μ long (range of means 33–37μ). *Chromosome number* n=36, 2n=72. Calcareous rock in Central and SE Europe. (Austria, Jugoslavia and Greece.)

A DISCUSSION OF RECENT NOMENCLATURAL ACTIVITY WITH REGARD TO THE ASPLENIUM TRICHOMANES COMPLEX

It is obvious that the production within one year of no less than three new specific names relating to a complex generally believed to consist of only two main taxa must inevitably result in confusion. It may assist clarification of this confusion if the publication of these names is discussed in more detail here:

1 THE CHOICE OF RANK Not infrequently, cytotaxonomists are reprimanded for an alleged tendency for over-enthusiastic production of new "cytological" species. For example, one may quote Davis & Heywood[14], who write with evident disapproval, "Thus, there is a school of cytotaxonomists which insists that diploids and polyploids must always be kept apart as separate species, no matter what the apparent degree of morphological differentiation involved."

The most ironic feature of the present confusion surrounding the nomenclature of the *Asplenium trichomanes* complex is that this confusion has manifestly been produced by classical taxonomists or nomenclaturalists reacting against the reluctance of the cytotaxonomists to give the segregates specific rank! It is very remarkable that although Meyer, who having first studied these plants for some ten years, produced the first taxonomic treatment of the cytotypes[2], regards them as deserving only subspecific rank,

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[14] DAVIS, P. H. and HEYWOOD, V. H., 1963. *Principles of Angiosperm Taxonomy*. Edinburgh, p.213.

COMPARISON OF THE SUBSPECIES OF *ASPLENIUM TRICHOMANES* IN EUROPE

		trichomanes	*quadrivalens*	*inexpectans*
RHIZOME SCALES	LENGTH	up to 3·5mm	up to 5·0mm	up to 3·5mm
	SHAPE	lanceolate	linear-lanceolate	lanceolate
	CENTRAL STRIPE	red-brown	dark brown	red-brown
FRONDS	LENGTH	8–18 (–25) cm	10–18 (–25) cm	7·5–10 (–12) cm
	PINNA PAIRS	(10–) 14–28	16–30	10–24
	SHAPE	tapering	tapering	abruptly terminated
	APEX	acute	acute	obtuse
PETIOLES	COLOUR	red-brown	dark brown	dark red-brown
PINNAE	LENGTH	0·25–0·75cm	0·4–1·2cm	0·4–0·8 (–1·0) cm
	TEXTURE	delicate	robust	delicate
	SHAPE	suborbicular, auriculate when luxuriant	oblong, parallel-sided	square or oblong, parallel-sided
	SEPARATION AT APEX	distant	crowded	sub-distant
	INSERTION (UPPER PINNAE)	oblique	square or ± oblique	square
	TERMINAL PINNA	narrow, inconspicuous	narrow, inconspicuous	broad, conspicuous
STOMATA	MEAN LENGTH	38–43μ	41–49μ	40–42μ
SORI	(MIDDLE PINNAE)	4–6 (–8)	(4–) 5–8 (–10)	4–7 (–10)
SPORES	MEAN LENGTH	29–36μ	34–43μ	33–37μ
CHROMOSOME NUMBER	(2n)	72	144	72
HABITAT		non-calcareous rocks	usually basic rocks	calcareous rocks
DISTRIBUTION IN EUROPE		C and N Europe especially in upland regions	throughout Europe but less frequent in North	C and SE Europe

certain other authors (taxonomists of more conventional approach), have almost immediately accorded them specific status.

I am not myself unduly concerned whether these segregates be given specific or subspecific rank. In the treatment of *Asplen um trichomanes* in *Flora Europaea* I have been content to accept for the segregates that rank which has been regarded editorially as most consistent with the concept of species as generally interpreted therein. The truth of the matter is that complexes of this type cannot be married satisfactorily to the recognised system of classification, and inevitably whatever rank is selected is subject to one objection or another. Thus the selection of specific rank for segregates of this sort has the real disadvantage of obscuring their close mutual relationship. On the other hand, the choice of subspecific status is equally objectionable on the grounds that it may conceal the existence of real genetic discontinuities. In my own opinion, there is a strong case for the acceptance of a new supra-specific category to circumscribe complexes of this sort. In other words, I advocate the recognition of the species aggregate as a formal taxonomic category, coupled with the use of some type of trinomial system to indicate segregates equivalent to specific rank, e.g., *Asplenium trichomanes: trichomanes* L. However, until the unlikely day when a system of this general type gains formal acceptance, one must continue to apply the existing categories as best one can.

2 THE SPECIFIC NAMES RECENTLY GIVEN TO SEGREGATES OF THE ASPLENIUM TRICHOMANES COMPLEX These are three in number. In order of publication, they are *A. lovisii* Rothm., corresponding to the tetraploid cytotype, *A. trichomaniforme* H. P. Fuchs, and *A. linnaei* Soó, the latter two corresponding to the diploid cytotype.

Rothmaler's work[4] was first circulated privately in page proof. It is of course most undesirable to quote names used only in an author's proofs and not appearing in the published work, since such names are unpublished and have no validity [15]. However, since Fuchs has seen fit to quote in synonymy names used by Rothmaler only in proof, the harm has already been done. In the proofs of Rothmaler's flora, the cytotypes of *Asplenium trichomanes* were given subspecific rank, the diploid as subsp. *trichomanes*, the tetraploid as subsp. *lovisii*. Only in the posthumously published volume is specific status given to the cytotypes. In view of the tragic death of Werner Rothmaler prior to the appearance of his flora, it is very unlikely that we shall ever know the reasons for the decision to promote to specific rank, and further discussion is not desirable. It is obvious that Rothmaler, a very competent taxonomist, must have intended to publish more formally on the complex, since his new name is not validly published in his flora, and indeed now remains a *nomen nudum*.

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[15] Cf. Recommendation 34A of the *Int.Code Bot. Nomenclature*.

Subsequently, Fuchs[5] reversed Rothmaler's decision as to the type segregate, and published a new name, *A. trichomaniforme* H. P. Fuchs, for the diploid cytotype. This name is illegitimate, being a later homonym of *A.* × *trichomaniforme* Woynar[16], given to a hybrid between *A. trichomanes* and *A. adulterinum* Milde. The most remarkable feature of Fuch's contribution is that he should consider that there was no necessity to give any reason for the change of type segregate. It must surely be obvious that unsupported decisions regarding the typification of Linnean species serve no useful purpose. Unconsidered or arbitrary decisions are in fact valueless and may indeed obscure the issue, since a later worker must start from the beginning, all the real work involved in typification, including elucidation of all the circumstances surrounding the original application of the name, still remaining to be done.

It is regrettable that Soó[5], in perceiving that Fuchs had made one major mistake, did not consider more carefully whether or not he may have committed others, before substituting another new name, *A. linnaei* Soó, for Fuchs' illegitimate name *A. trichomaniforme*. Both Fuchs and Soó have entirely overlooked the necessity to respect the principle of priority of publication, and the need therefore to investigate the existing valid names synonymous to *A. trichomanes* s.l., in spite of the fact that no less than twelve synonyms (exclusive of attributions to genera other than *Asplenium*), are given by Christensen[17]. One of the oldest and most important of these synonyms is *A. melanocaulon* Willdenow. Owing to the co-operation (in the absence of Dr Meyer), of Dr Buchheim of the Botanisches Museum, Berlin-Dahlem, I have been able to study spores, rhizome scales, and photographs of the holotype of this species. This specimen is unequivocally diploid (mean spore length 29·7 μ, in the air). *A. melanocaulon* is based on a North American specimen, but since there is no appreciable difference between North American diploid plants and type material of Meyer's subsp. *bivalens* (on which *A. linnaei* Soó is based), *A. melanocaulon* Willd. must take precedence over *A. linnaei* Soó, which lapses into synonymy as a superfluous name.

It must surely be evident that in a group so difficult as the *Asplenium trichomanes* complex, the publication of new names without adequate study serves no useful scientific purpose, and can only lead to more confusion which the Code of Nomenclature enables us to resolve, but which it is powerless to prevent. As a botanist primarily concerned with studies on evolution, I grudge the effort spent on the clarification of tiresome and unnecessary nomenclatural tangles. One is acutely aware that only by future authors exercising responsible caution will it be possible to avoid the

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[16] WOYNAR, H., 1913. *Mitteil.Naturwiss.Ver.Steiermk.* **49**:153.
[17] CHRISTENSEN C., 1906. *Index Filicum*, and supplements (1913, 1917, and 1934

creation of further nomenclatural chaos in this much abused but interesting group of ferns.

ACKNOWLEDGEMENTS

First of all, I must make it quite clear that I accept total and sole responsibility for the content of this paper. The opinions expressed herein are my own, and acknowledgement of assistance from the persons mentioned below must not be interpreted as implying acceptance by them of my views.

I am very grateful to J. Armitage, Prof. H. Melzer, Prof. T. Reichstein and Miss A. Sleep for living collections of subsp. *inexpectans*. My greatful thanks are due to the Director and Dr G. Buchheim of the Botanisches Museum, Berlin-Dahlem, for the loan to the British Museum, of spore and rhizome scale preparations of the holotype specimen of *A. melanocaulon* Willd. and to Dr Meyer of the same institution, for his generous co-operation with regard to the re-investigation of spore sizes and for type material of his subspecies. I owe a particular debt of gratitude to A. C. Jermy, who has helped in many ways too numerous to describe, and to Professor Manton, for her valuable advice and constant encouragement.

TWO SPECIES OF *DIPLAZIUM* IN EUROPE

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It has long been the subject of debate as to whether *Athyrium* and *Diplazium* should be treated as distinct genera and, if so, as to what criteria should be used to distinguish them or whether, in fact, intermediate genera should be recognised. The problem will not be solved without intensive monographic work[1] and it may therefore be considered presumptuous to transfer *Athyrium crenatum* (Sommerf.)Rupr. and *A. umbrosum* (Ait.) C. Presl to *Diplazium* without considerably wider researches.

However, as is well known, two chromosome base numbers have been found within the complex: n=40 in *Athyrium* and n=41 in *Diplazium;* it is believed that both the species above have n=41,[2], [3]. They have oblong or linear, flap-like (asplenioid) indusia and on numerous fronds examined, sori have never been found lying back to back on the same vein. Both have bipinnate-tripinnatisect fronds arising singly or in groups of two or three from a creeping rhizome. Furthermore, the rounded outline of the base of the lower-most pinnae (i.e., those pinnules nearest the rhachis are shorter than the second pair) is distinct from that in *Athyrium;* in the latter the basal pair is distinctly longer than the second pair, giving an auriculate outline to the pinna.

Diplazium sibiricum (Kunze) Jermy **comb.nov.**

Asplenium sibiricum Kunze, *Anal.Pterid.* 25, t.15 (1837).

Aspidium sibiricum Turcz. in *Flora* **1834,** Beibl.**1**:28 (1834) *nomen nudum.*

Aspidium crenatum Sommerf. in *Vet.Akad.Handl.* **1834**:102 (1835); non *Diplazium crenatum* Poir. (1811).

Cystopteris crenata (Summerf.) E. Fries, *Nov.Fl.Suec.Mant.* **3**:165 (1842).

Athyrium crenatum (Summerf.) Rupr., in Nyland., *Spicil.Pl.Fenn.* **2**:14 (1844).

Asplenium crenatum (Sommerf.) E. Fries, *Summa Vegt.Scand.* **1**:253 (1846).

Athyrium mite Christ in *Bull.Acad.Géogr.Bot.Mans* **1909**:36 (1909).

Athyrium idoneum Kom. in *Bull.Jard.Imp.Bot.Pierre le Grand* **16**: 148 (1916).

Kunze based his name on Turczaninov's plant from the Baikal region of Dauria and refers to a specimen in herb. De Candolle. There is also a specimen labelled "*Aspidium sibiricum mihi, Trentia* **1828**. *Turcz.*" in the herbarium of Oxford University (OXF) (!) which agrees very well with Norwegian material. Eastwards the species extends to Japan where Tagawa has described a variety *glabrum*[4]. Christ described a species, *Athyrium mite*, from Sagalien which, from an isotype at the British Museum is identical with *D. sibiricum.* The range is extended westwards via central Asia, the Urals and Karelia to Finland and to relict localities in the Gudbransdalen, Norway.

Diplazium caudatum (Cav.)Jermy **comb.nov.**; non *D. caudatum* J.Sm. (nomen nudum).

Tectaria caudata Cav. in *Anal.Cienc.nat.Madrid* **4**:100 (1801).

Polypodium umbrosum Aiton, *Hort.Kew.* **3**:466 (1789); non *Diplazium umbrosum* Willd. (1810).

Aspidium umbrosum (Ait.) Swartz in Schrader, *Journ.Bot.* **1800**(2):42 (1801).

Allantodia umbrosa (Ait.) Kaulf., *Enum.Fil.*179 (1824).

Asplenium umbrosum (Ait.) J.Sm. in Hook., *Journ.Bot.* **4**:174 (1842); non Villar (1786) nec Kaulf. (1824).

Asplenium axillare sensu J.Sm., *Bot.Mag.* **72,** *Comp.*30 (1846), excl.syn.

Asplenium aitonii Moore, *Ind.Fil.*xlix (1857).

Cavanilles based his name on a plant collected by Broussonet on Teneriffe, Is. Canarias; the type is presumably at Madrid. The species is also found on the Açores, Madeira and the Cape Verde Is.; it has no close relative on the African mainland. The *Athyrium australe/tenerum* complex of Australasia has been confused with *A. umbrosum* in the past. Whilst superficially very close, the balloon-like (allantodioid) indusia which usually split along the top, puts the Australasian complex into a different section.

The epithet *axillare* (Ait.) is often applied to this species under various genera. *Polypodium axillare* Ait. was published in the same book as *P. umbrosum* Ait. and there is a specimen in Herb. BM labelled "*Hort.Kew. 1780 e Madeira*" and named *Polypodium axillare* in Solander's hand[5]. We can only assume that this was a plant sent back by Frances Masson and grown on at Kew under that name; it is however, a form of *Athyrium filix-foemina* (L.) Roth. John Smith, on the other hand, on the Garden's staff at Kew from 1822-64, had a different concept. Although he referred in synonymy to *P. axillare* Ait. when publishing *Asplenium axillare* J. Sm. it is obvious from

his herbarium (at BM) that the plant, grown at Kew at that time under *Asplenium axillare*, was *Athyrium umbrosum*. Smith's concept of *Asplenium* (i.e., *Athyrium*) *umbrosum* was a smaller plant with less open fronds and he remarked on a herbarium sheet "although W. Hooker had the opportunity of seeing living specimens he seldom liked to look at them — if he had done so he would not have united *A. umbrosum* and *A. axillare*". So in respect to this great gardener further study on living plants from Macaronesia may pay dividends — on the other hand, movable pot-labels may be the source of error!

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Recently R. C. CHING, in *Acta Phytotax. Sinica* 9:41-84 (Jan. 1964), proposed several new genera in *Athyriaceae*. The two species mentioned here fit on vegetative grounds into **Allantodia** R.Br. which Ching segregates as distinct from *Diplazium*, but have an indusium of the asplenioid type which characterises the *Athyrium mesosorum* Makino-*Diplazium chrysocarpus* v.A.v.R. group which is put into a new genus **Rhachidosorus** Ching.

[2] BRØGGER, A., 1960, *Blyttia* **18**:33-47 [where the author found n=41 in Norwegian *A. crenatum* and pointed out the affinity of this species to *Diplazium*].

[3] Prof. I. MANTON counted Maderan material of *A. umbrosum* and obtained a *very strong* indication of **n=41**; later attempts to establish the exact number have so far failed due to lack of suitable material. (personal communication).

[4] TAGAWA, M.,*Acta Phytotax. Geobot.* **11**:238 (1942).

[5] Aiton took his specimens to Banks' Library where they were examined by Solander, whose descriptions were utilised by Dryander in the first edition of *Hortus Kewensis*. [see Stearn, W.T., *Cat.Bot. Books in the Coll. of R.McM.M.Hunt:* cviii (1961)].

THE EUROPEAN CHAINFERN IN CORSICA*

In May 1963, I discovered in Corsica four tufts of *Woodwardia radicans* Swartz, a fern not previously known in this area. It was growing in the upper part of the Sisco valley of Cap Corse, well sheltered by 600–1000 metre mountains against cold, desiccating, north and west winds. This valley is accessible only to the " Levante " and the " Gregale ", both humid warm easterly winds which periodically give it almost subtropical conditions. The tufts grow near the river in the midst of a very dense stand of *Alnus glutinosa*, *A. cordata*, *Castanea sativa* and *Juglans regia*, and do not receive direct sunlight at any part of the day. Unlike some Spanish localities for *Woodwardia*, the hardly accessible Corsican station seems to be quite natural and untouched by man. Each tuft was up to one-and-a-half metres high with five to seven fertile fronds of the previous year's growth.

LUDWIGSHAFEN-am-RHEIN GERHARD SCHULZE

• SCHULZE 1963. Découverte de la fougère *Woodwardia radicans* Sw en Corse. *Bull.Soc.Sci.Hist. Nat.Corse* **83** (569):55.

ASPLENIUM MAJORICUM Litardière

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During the course of preparation of the account of the genus *Asplenium* for the forthcoming *Flora Europaea*[1], we have had cause to investigate one species, *A. majoricum* Litard., which, although described more than fifty years ago, has remained an obscure taxon. This plant, which is apparently endemic to the Balearic Islands, has scarcely come to the attention of British botanists, and was indeed until recently unrepresented in the herbaria at the British Museum or Kew.

To our great good fortune we have had available to us material of this species collected by J. Orrell in 1959 from the *locus classicus*, the town of Sóller in Majorca. This gathering is represented by a specimen in the Herbarium of the Department of Botany at Liverpool University, and by another specimen in cultivation in the Botanic Garden of the same University. Subsequently, a number of plants have been raised at Leeds from spores obtained from the original plant in cultivation at Liverpool and specimens from these are now in Herb. B.M.

A combination of morphological and cytological studies has left us in no doubt that *A. majoricum* Litard. is in fact a species, fully distinct from any other species of *Asplenium* known to us. For a variety of reasons, our investigation of *A. majoricum* was not completed in time for this species to receive full treatment in *Flora Europea* and consequently a description of this plant, drawn up according to the conventions used in the *Flora*, is given below, together with an indication of its position in the key to the genus provided in that work.

COMPARISON WITH OTHER EUROPEAN SPECIES OF ASPLENIUM As can be seen from the silhouettes illustrated (FIGS. 1 and 2), *Asplenium majoricum*, though variable, is nevertheless a very distinctive species. It has perhaps most often been confused with *A. fontanum* (L.) Bernh., but *A. majoricum* has less

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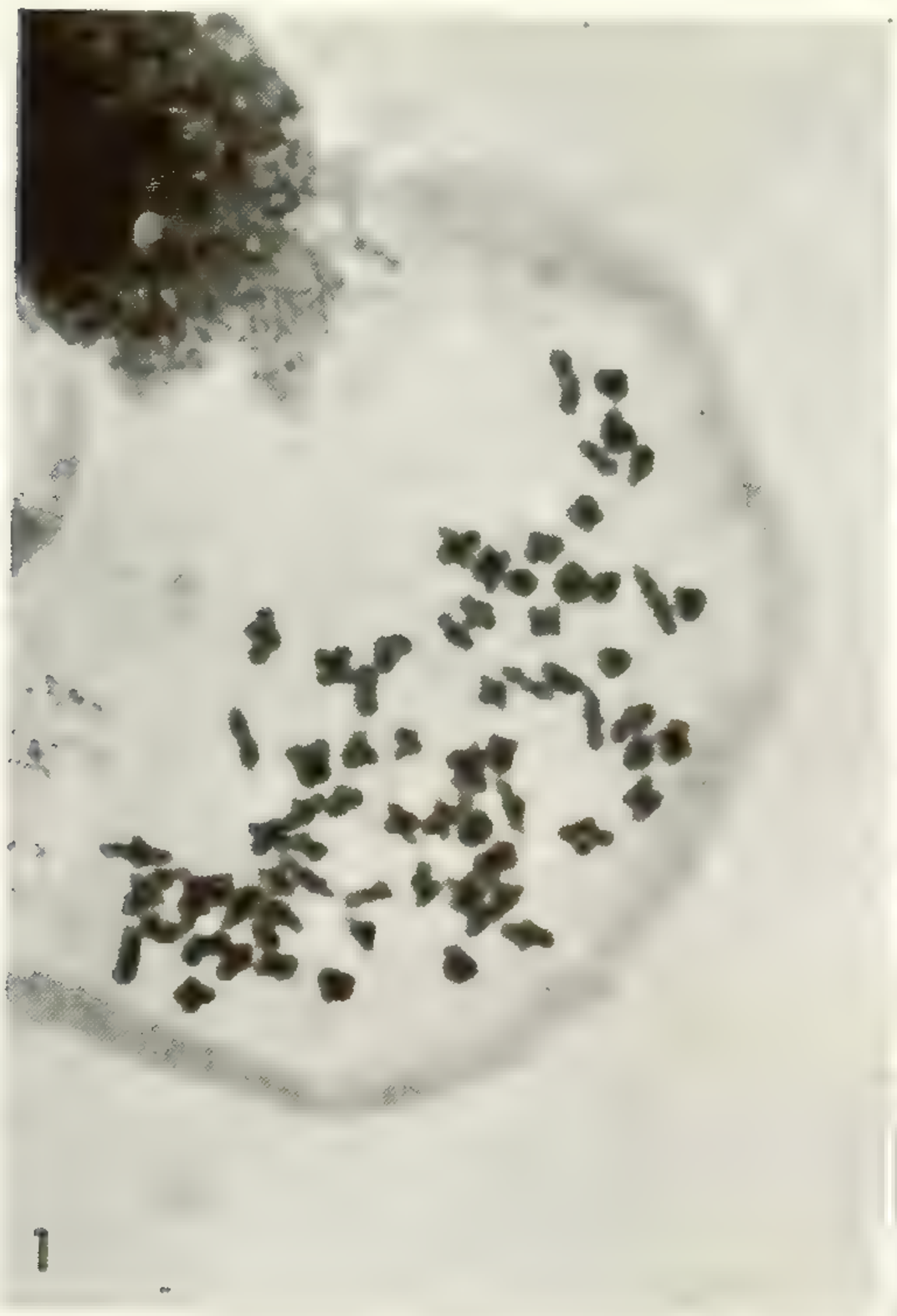
[1] Flora Europea Vol. 1 (Pteridophyta - Platanaceae) Ed. D. H. VALENTINE *et al.* In press.

TEXT-FIG. 1 Photo-copy silhouettes (reproduced natural size) of fertile fronds of *Asplenium majoricum*, all from plants in cultivation at Leeds, except frond at bottom right, which is one of the fronds sent by Dr Ball from which the Leeds culture was raised. Arrowhead marks indicate maximum extent of black colouration on underside of rhachis.



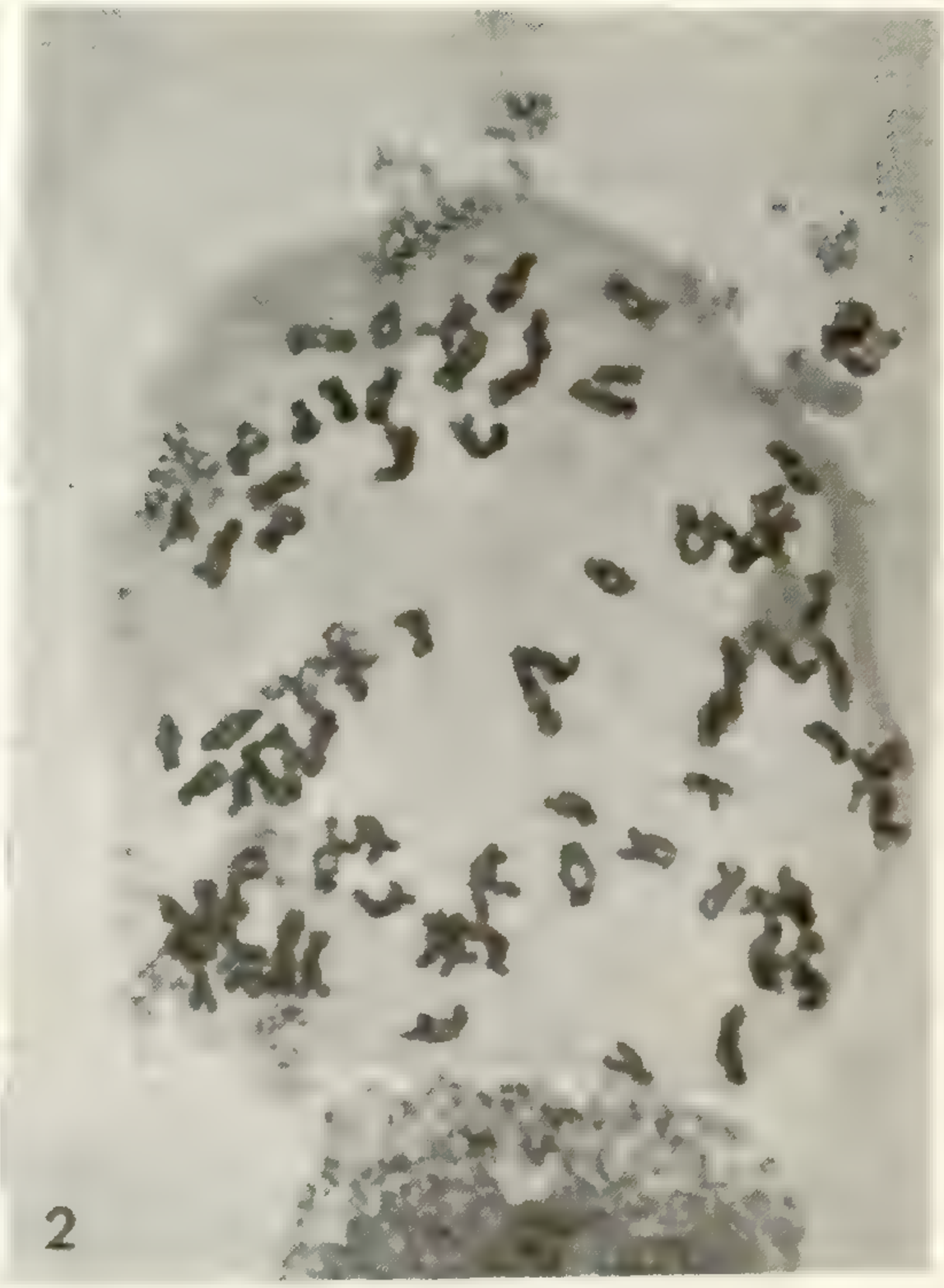


PLATE I Cytology of *Asplenium majoricum*. Permanent aceto-carmine preparations of meiosis, photographed using Leitz 2mm N.A. 1.4 apochromat, with × 10 ocular. Magnification 1000. FIG. 1 Metaphase I showing n = 72 bivalents. FIG. 2 Late diplotene, also showing n = 72 bivalents. Chiasmata clearly displayed, two or more per bivalent. Four bivalents associated with nucleolus. FIGS. 3 and 4 Explanatory diagrams to FIGS. 1 and 2 respectively.

finely dissected pinnae, the lobes of which are broader than in *A. fontanum*, with obtuse, not acute, teeth. *A. majoricum* may readily be distinguished from *A. obovatum* Viv., *sensu stricto*, by the characters of the pinnae, which are more triangular in outline in *A. obovatum*, and with lobes of more rounded shape than in *A. majoricum*. The pinnae also differ in their dissection, being bipinnate below in *A. obovatum* but never more than pinnatifid in *A. majoricum*. This last character also serves to distinguish satisfactorily *A. majoricum* from *A. billotii* F. Schultz (*A. lanceolatum* Huds.). In degree of dissection of the frond, *A. majoricum* most nearly resembles *A. forisiense* Le Grand, but the pinnae are shorter and more distant, and the segment teeth are less mucronate than in *A. forisiense*.

In *A. majoricum* the rhachis is thin and wiry, in contrast to the relatively thick and inflexible rhachis found not only in *A. forisiense*, but also in *A. obovatum*, *A. billotii*, and *A. fontanum*. A further distinctive feature of the rhachis, again serving to distinguish *A. majoricum* from all these four species, is its colour. On the undersurface of the frond the rhachis and stipe are deep shining black in colour for about two-thirds of their combined length. However, when grown in less favourable conditions, the fronds remain small, and this character is not so evident. The frond is then less divided, with the upper pinnae even entire. In this condition, which may obtain in nature in excessively sun-exposed and dry situations, *A. majoricum* might be mistaken for stunted forms of *A. viride* Huds. or *A. obovatum*, but *A. majoricum* can always be readily distinguished from all but aberrant forms of *A. viride* by the dissection of the lower pinnae, which are always pinnatifid in *A. majoricum*, while even in reduced forms *A. obovatum* has a massive appearance quite different from the relatively delicate *A. majoricum*. In *A. trichomanes* L. the rhachis is black to the tip, easily distinguishing this species from even dwarf forms of *A. majoricum*.

The only other species with which *Asplenium majoricum* could reasonably be confused is *A. petrarchae* (Guérin) DC., but *A. majoricum* is quite glabrous, totally lacking the conspicuous glandular hairiness of *A. petrarchae*.

Amendment to the key to Asplenium (see Fl.Eur.**1**:14)

10	Pinnae adnate to rhachis	8	*jahandiezii*
10	Pinnae shortly stalked		
10a	Lower pinnae suborbicular, not deeply cut	7	*viride*
10a	Lower pinnae oblong-triangular, pinnatifid or deeply cut	9/1	**majoricum**

9/1 **A. majoricum** Litard. in *Bull.Géogr.Bot.Mans* **1911**:28 (1911) (*A. lanceolatum* var. *majoricum* (Litard.) Sennen & Pau). Rhizome erect; scales without dark central stripe. Leaves 8–12cm, petiole c. one-third the length of the lamina, wiry, dark at base, shiny black on the underside (adaxial side)

TEXT-FIGURE 2

Photo-copy silhouettes (reproduced natural size) of fertile fronds from plants in cultivation at Leeds. FIG. 1 and 2 *Asplenium obovatum*, ex Capo di Testa, Sardinia (FIG. 2 diminutive form). FIG. 3 *A. billotii* ex Ronco, Canton Ticino, Switzerland. FIG. 4 *A. fontanum*, ex Roche, Canton Vaud, Switzerland. FIG. 5 *A. forisiense*, ex Peuchot, Dept. Lot, France. FIG. 6 *A. viride*, ex Saalbach, Germany.

greenish above; lamina elliptical to oblanceolate, pinnate-pinnatifid; light green in life, dark green on drying; rhachis green above, black beneath for ½ its length; median pinnae 8–10mm, lower decrescent and distant, pinnatifid or deeply lobed, segments with broad obtuse teeth without a mucro. Sori small, lying near the midrib of the pinna; indusium persistent, deeply and conspicuously lobed; spores 35 50μ (mean 42·8μ), perispore irregularly echinulate, sometimes with cristate wings, surface shallowly reticulate or wavy cristate. 2n=144. *Dry stone walls.* ● *Soller, Islas Baleares.* Bl.

CYTOLOGY Examination of meiosis in plants in cultivation at Leeds has shown that *A. majoricum* is tetraploid, with a regular meiosis showing n=72 bivalents. (see PLATE III). The provenance of the investigated plants is given above (p. 163).

This finding of a tetraploid chromosome number in *A. majoricum* is in contrast to the diploid chromosome number (n=36, 2n=72), found in *A. fontanum*[2], [3], *A. obovatum*[4], and *A. viride*[2], [3]. Of the other species discussed in this paper, *A. billotii*[2], [4], *A. petrarchae*[2], and *A. forisiense*[5] are tetraploid. while both diploid and tetraploid levels are known in European *A. trichomanes*[2], [6], [7].

THE AFFINITIES OF ASPLENIUM MAJORICUM The chromosome number of *A. majoricum* indicates that it is at least possible that this plant is yet another allotetraploid species amongst European *Asplenium*. Nevertheless, even if this suggestion happens to be correct, the parentage of *A. majoricum* remains uncertain, and it is probably wisest that further speculation concerning the nature and origin of *A. majoricum* is withheld pending the outcome of an investigation into the cytogenetic affinities of *A. majoricum* which is now in progress at Leeds University.

Our grateful thanks are due to Dr P. W. Ball who on his own initiative sent us the pressed mature fronds from which were raised the plants of *A. majoricum* used in this investigation.

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THE *POLYPODIUM VULGARE* COMPLEX IN NORTH AMERICA

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The *Polypodium vulgare* complex in North America taken in the broad sense consists of at least five, extremely variable, distinct species. The majority of these occur on the western seaboard. Since the massive work by Eaton (1879) on North American ferns the conceptual limits of these species as related to *P. vulgare* s.l. has varied from almost complete synonymy with the latter to complete taxonomic recognition as independent entities. It has only been since 1950 that the true evolutionary picture has begun to emerge, primarily through the efforts of Drs Irene Manton and Molly Shivas. The evolution of the complex in Europe, clarified by the use of cytology, cytogenetics, morphology, ecology and geographical distribution, has aided in explaining some of the perplexities of the complex in North America.

It is now apparent that there are two major species complexes in America one centering around *P. virginianum* L. and the other about *P. glycyrrhiza* D. C. Eaton. The cytotaxonomic study of these species has not, as yet reached the refined state known of European members of the complex. By utilizing the methods of Manton (1950) and Shivas (1960a, b; 1962) we are endeavouring to clarify some of the remaining problems.

This paper summarizes the current concepts of the complex in North America. However, there is still much work to be done before the evolution and systematics of the species can be clarified.

Polypodium californicum Kaulf.

Polypodium californicum is a complex of two cytological races, a diploid ($n=37$) occurring from San Francisco, California, south to Baja California, Mexico; and a tetraploid ($n=74$) occurring in California from Monterey County to Humboldt County, and the foothills of the Sierra Nevada range (Lloyd, 1963). Hybrids between these races have not been found. Plants also occur on the Santa Barbara Islands, California, and Guadalupe Island off the coast of Baja California.

FIGURES 1 - 5: Frond silhouettes of North American species of *Polypodium* (× ½). 1 *P. californicum;* 2 *P. scouleri*, coastal form; 3 *P. glycyrrhiza* with attenuate frond segments; 4 *P. hesperium;* 5 *P. virginianum*

1
2
3
4
5

This fern is commonly found growing on moss-covered rocks and bluffs throughout the northern part of its range. Plants of the drier regions, such as southern California and the foothills of the Sierra Nevada range, are usually in the rich soil of shaded canyons or form an understory to more xerophytic vegetation. Occasionally, *P. californicum* is found growing epiphytically on moss-covered tree trunks and branches.

The herbaceous deciduous fronds drop during the early part of the summer dry season. Fronds of tetraploid plants may persist throughout it if sufficient ground water is available.

Fronds of both cytological races are ovate to oblong-lanceolate (see FIG. 1) and range up to 590mm long and 395mm wide. Margins of most fronds are serrate or serrulate. The number of pinnae is not constant and is related to the length of the frond. As many as 69 pinnae have been observed on plants growing in the mesophytic habitat of the coastal forest. Pinnae endings are acute-attenuate to round.

Sori are less than 3mm broad and are round to oval. Annuli have 10–21 indurated cells. Although paraphyses are generally lacking, a plant from San Clemente Island which resembles *P. australe* was found to have them in abundance. These are similar to those illustrated by Martens (1950b) and Shivas (1960a) for *P. australe*.

Plants with irregular meiosis and inviable spores have been found beneath the lower Yosemite Falls in the central Sierra Nevada range. This population is somewhat isolated geographically and its evolution is unknown. Manton (1951) observed 37 univalents and 37 bivalents in plants from Pt. Reyes, California. Plants investigated from this locality have less than 10% spore fertility and are morphologically intermediate between *P. californicum* and *P. scouleri*. Due to these characteristics they are believed to be hybrids (Lloyd, 1962). All of these plants were found growing among the matted rhizomes of *P. scouleri* on the bluffs above the ocean. Additional plants with intermediate characteristics have been found on Morro Rock, San Luis Obispo County.

Polypodium californicum and *P. glycyrrhiza* are difficult to separate morphologically in areas of sympatric occurrence. As the range of the tetraploid *P. californicum* is identical with the overlapping range of the two species it can be hypothesized that the allotetraploid *P. californicum* is a product of hybridization between diploid *P. californicum* and diploid *P. glycyrrhiza*. This would produce plants intermediate between the parents and account for the difficulty in separating them.

Polypodium californicum var. *kaulfussii* D. C. Eaton was segregated from the species by its coriaceous fronds and regular series of areoles on each side of the midrib. This variety inhabits coastal bluffs and occurs sporadically throughout southern California in moderately more xeric habitats than var. *californicum*. Studies have shown these plants to be morphologically the

same as the species in all other characteristics (Kendall, 1923; Lloyd, 1962). Although frond coriaceousness is ecotypically controlled they grade imperceptibly into the herbaceous leaves of the species.

Chesnut (1902) reported that the juice of the rhizome of the California polypody was used by Indians of Mendocino County for treatment of open sores and rheumatism. Root extracts were sometimes used as an eyewash.

Frond aberrations such as lobed or cleft pinnae are somewhat common in the species. Morton (1961) gave *forma* status to two such individual plants emphasizing their lobed or deeply laciniate segments.

Polypodium glycyrrhiza D. C. Eaton

Polypodium glycyrrhiza is a coastal diploid species ($n=37$) which extends from Kamtchatka along the Aleutian Islands to Alaska; south through British Columbia, Washington, and Oregon to central California. In the southern half of its range it extends east only to the Cascade Mountains, where it is found growing in the valleys of the major rivers as far inland as Yale on the Fraser River and Hood River on the Columbia River. It is also found at Hazelton on the Skeena River in the Coast Mountains of western Canada.

The species is apparently uniformly diploid (Manton, 1950, 1951; Taylor and Lang, 1963). Since Shivas (1960a) has shown *Polypodium vulgare* s.s. to be a distinct tetraploid species and has evidence that indicates that *P. glycyrrhiza* might be one of the possible ancestors of it, it seems illogical that the two taxa should be considered conspecific.

The Makah Indian name for this species is translated " crawling root on trees " (Gunther, 1945) attesting to the typical habitat of the species on the Olympic Peninsula of Washington. Throughout most of its range *P. glycyrrhiza* may be found growing as an epiphyte on the trunks and horizontal branches of trees. In Washington, Oregon, and southern British Columbia the species is often found growing as an epiphyte on the big leaf maple, *Acer macrophyllum* Pursh. It has also been found growing on willow (*Salix*), elderberry (*Sambucus*), alder (*Alnus*) and spruce (*Picea*). In addition, however, it is found almost as frequently on rock surfaces, stumps and logs.

This species can be distinguished in the field on the basis of its thick, sweet rhizome, uniformly colored scales, free vein endings, and round sori located midway between the margin and the costa of the lanceolate, often attenuated, acute frond segments (see FIG. 3). The rock form often has shorter fronds with less attenuated segment tips. New fronds appear in the autumn about the time the rainy season begins.

The specific epithet *glycyrrhiza* is an allusion to the sweet, licorice taste of the rhizome (the legume *Glycyrrhiza glabra* is the source of commercial licorice).

Fischer and Lynn (1933) investigated *P. glycyrrhiza* as a possible source of licorice and found that no glycyrrhizin (a compound found in true licorice that is fifty times sweeter than sugar) was present. They concluded that the licorice-like taste was due to a mixture of a glucoside polydin, various unidentified substances, and sucrose.

The Indians of western Washington used the rhizome either raw or cooked as a cough medicine. The Cowlitz Indians of the Columbia River used an infusion of the crushed rhizome boiled with young fir needles as a treatment for measles (Gunther, 1945).

Polypodium hesperium Maxon

Polypodium hesperium is more continental than *P. glycyrrhiza* or *P. californicum* being found in the montane areas of western North America. Its distribution is from Alaska, south along the Rocky Mountains to Arizona, New Mexico, and Baja California; east from the Olympic, Cascade, and Sierra Nevada ranges to Colorado and North Dakota. It is not present in the Great Basin region of Utah and Nevada. The range of this species approaches that of *P. californicum* in the Sierra Nevada Mts. and overlaps the range of *P. glycyrrhiza* in Washington and British Columbia.

This montane polypody is found growing on rocks and in narrow rock crevices from moderate (500ft. in British Columbia) to high (9,000ft. in Arizona) elevations. It is rarely if ever found growing as an epiphyte. In British Columbia it produces new fronds in the spring before the dry season begins.

Polypodium hesperium appears to be a polymorphic species with at least two cytological races. The diploid ($n=37$) was first reported from the Columbia River Gorge (Manton, 1951). Taylor and Lang (1963) found diploid populations in British Columbia. Both Knobloch (1962) and Lloyd (1963) report tetraploidy ($n=74$) for the species in Arizona.

Polypodium hesperium can be distinguished from the other North American taxa by its relatively small segments with rounded blunt tips (see FIG. 4). The diploid is similar to *P. virginianum* in having characteristic glandular paraphyses and marginal sori.

The diploid has been postulated by A. Murry Evans (pers. comm.) to be the other ancestor of the tetraploid *P. virginianum*. He finds that in many respects (e.g., the shape of epidermal cells) the tetraploid *P. virginianum* is intermediate between the diploid *P. hesperium* and the diploid *P. virginianum*. Shivas (1960a) has found by crossing the two North American cytotypes of

P. virginianum with European taxa (*P. vulgare* s.s.) of higher ploidy level, that the hybrids produced had no paraphyses. If the character is genetically recessive, as it appears to be, Evans argues that both parents probably had paraphyses since they are present in the tetraploid *P. virginianum*. The diploid *P. hesperium* with paraphyses therefore seems to be a likely candidate for the other parent.

Polypodium scouleri Hook. & Grev.

Polypodium scouleri is a diploid species ($n=37$) (Taylor and Lang, 1963) and is the most distinct of the North American *P. vulgare* complex. The species is entirely coastal occurring from British Columbia south to Monterey County, California, and disjunctly on Morro Rock, San Luis Obispo County, in the Santa Barbara Islands and Guadalupe Island. It can be easily recognized in the field by its very coriaceous evergreen fronds with crenate margins and its thick rhizome which is glaucous or pruinose.

The habitat of *P. scouleri* is in shallow soil or rocky crevices on coastal bluffs or within forested areas. In the northern part of its range it is frequently epiphytic on moss-covered trees. The island habitats of the fern are mesophytic in nature and tend to indicate a more continuous distribution of the species throughout coastal California during past periods of wetter climate. Parish (1901) reported that the original collector of the species on Guadalupe Island found it "encircling the trunk of a single oak, in a thick mat of moss, and constantly wet by fogs, covering the tree with a network of its strong, tough roots to a height of ten feet ".

Maximum frond sizes up to 89cm long and 22·5cm wide occur in plants growing in the more mesophytic habitats of the coastal forest. In exposed coastal bluff habitats plants usually do not have fronds longer than 40cm. Fronds are deltoid to ovate in shape with 3 to 33 pinnae (see FIG. 2). The great majority of pinnae have rounded endings. Sori are round to oval and over 3mm broad. Sporangia have 12 to 20 indurated cells in the annulus, greatly overlapping the range found in *P. californicum*.

Polypodium virginianum L.

Polypodium virginianum is a polymorphic species found in eastern North America and eastern Asia. It is a complex of two cytological races, a diploid ($n=37$) and a tetraploid ($n=74$). Natural triploid hybrids have been found between these races (Manton, 1957; Evans, pers. comm.) with 111 sporophytic chromosomes.

Polypodium virginianum s.l. is distributed in North America from the Arctic Circle south through northeastern British Columbia, Alberta, Manitoba to Alabama and Georgia (where its range overlaps with another distinct species of the southeastern United States, *Polypodium polypodioides*

(L.) Watt var. *michauxianum* Weath.) and east from northeastern North Dakota, Minnesota, and Illinois to the Atlantic Ocean.

Manton (1957) reports that the diploid race is one of more northern latitudes and montane regions, while the tetraploid race is found in lowland areas and southern regions. Evans (pers. comm.) has found that the triploid plants have a somewhat independent and southern range. He suggests that the triploid has successfully circumvented its sterility barrier by reproducing apomictically.

Analysis of pairing behavior of the chromosomes at meiosis in synthesized hybrids between the diploid and tetraploid races has shown that the diploid is one of the ancestral parents of the tetraploid (Shivas, 1960a).

The habitat and general appearance (see FIG. 5) of this species is adequately described by its French Canadian name *tripe de roche*. This name, according to Cobb (1956), refers to the rich, velvety, mantle-like appearance of the species as it grows over rocks. The species is commonly found growing on rocks or rock ledges in shady woodlands. It is not often found as an epiphyte, although it occasionally grows on trees and stumps. *Polypodium virginianum* produces new fronds in the summer with the spores maturing by August or September.

The polypody of the eastern United States and Canada was for many years considered to be identical with *P. vulgare* of Europe. M. L. Fernald (1922) offered strong morphological evidence that the *Polypodium* of eastern North America was a distinct entity. He separated *P. virginianum* on the basis of its soft spongy, narrow, somewhat acrid rhizome, with its scales darkened on the back, and its nearly marginal sori. This is contrasted to *P. vulgare* with its sweet, firm rhizome with uniformly pale-cinnamon to castanaceous scales and medial sori. The two complexes differ also in the characteristics of the glandular paraphyses among the sporangia (Martens, 1950a).

Meiotic analysis of hybrids between the diploid *P. virginianum* and the tetraploid *P. vulgare* s.s. suggests that the North American diploid race is one of the probable ancestors of the European tetraploid (see Shivas, 1960a, 1962 for details). This is a particularly interesting situation since *P. virginianum* is restricted to North America and eastern Asia.

Some work has been done on the comparative morphology of the two main cytological races (Manton and Shivas, 1953; Evans, pers. comm.). Manton and Shivas found that the characteristic paraphyses are present in both the diploid and tetraploid plants but there were many fewer in the latter (4 as against c.20 per sorus). They also found the cells of the tetraploid to be somewhat larger. Evans finds that the tetraploid plants are typically smaller, narrower, with the lower pinnae shorter rather than longer, more

upright, and the pinnae tips rounded rather than angular.

Fernald (1922, 1950) does not recognize any varieties or subspecies of *P. virginianum*. He does, however, give the status *forma* to nine morphological aberrations which are of local or very exceptional occurrence. These freaks are of little biological significance but are much sought after by fern collectors for horticultural purposes.

CONCLUSIONS

From the above discussion several characteristics have emerged which may be used to delineate the species currently recognized in North America. These are given below in the form of a key.

Sori marginal, with paraphyses

Pinnae lanceolate, acute to obtuse; mostly eastern North America ..... *P. virginianum*

Pinnae oblong to obovate, obtuse to rounded; western North America ..... *P. hesperium* (diploid)

Sori medial, without paraphyses

Rhizome glaucous to pruinose; fronds coriaceous ..... *P. scouleri*

Rhizomes not glaucous to pruinose; fronds usually herbaceous

Pinnae usually less than 3cm long; montane southwestern United States ..... *P. hesperium* (tetraploid)

Pinnae usually more than 3cm long; coastal western North America

Frond veins free; apex of pinnae acute to attenuate ..... *P. glycyrrhiza*

Frond veins anastomosing into areoles; apex of pinnae acute to round

Fronds herbaceous ..... *P. californicum*

Fronds coriaceous .....

P. californicum var. *kaulfussii*

The cytological evidence to date has shown that the *Polypodium vulgare* complex in North America consists of nine cytological races, more or less distinct but interrelated. *Polypodium scouleri* is morphologically the most distinct and seems to have had little or no part in the evolution of the remaining members of the complex. On the other hand it can be shown that the tetraploids *P. californicum* and *P. virginianum* have possibly evolved through hybridization between closely related members of the complex within the bounds of North America.

In comparing the distribution of polyploid races with the entire complex it is interesting to note that *P. hesperium* and *P. virginianum* are the only species with diploids occupying more northern latitudes than tetraploids. This can be contrasted to the situation found in *P. californicum* and the European members of the complex. In addition, the habitat occupied by tetraploid *P. californicum* seems to be much more favorable for the species than that occupied by the diploid.

Of special interest are the isolated populations of *Polypodium* found on the Santa Barbara Islands and Guadalupe Island. These plants generally exhibit characteristics somewhat different from the mainland populations as a whole (e.g., spore surface, paraphyses).

In Europe the number of indurated cells in the annulus has proved to be a valuable tool in delimiting the species. This does not seem to be the case in North America. The number of indurated cells is quite constant in *P. virginianum*, *P. glycyrrhiza*, and *P. hesperium* averaging 12–14 per sporangium (range from 9–24). In *P. californicum* and *P. scouleri* the number of cells overlaps so greatly that it is not a useful character.

Fernald (1922) used the base of the rhizome scale as a means of separating *P. virginianum* and *P. vulgare* s.l. He found that in *P. virginianum* the scale had a sinus leading to the point of attachment while in *P. vulgare* it was peltately attached. Careful examination of the base of the scale of *P. glycyrrhiza* (considered a variety of *P. vulgare* by Fernald) has shown that it is not peltately attached but that there is a sinus leading to the point of attachment. The peltate appearance is caused by an overlapping of the lobes of the sinus.

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CULTIVATED FERNS

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Ferns in cultivation, like many things, have phases of popularity. A century ago, particularly in the British Isles, the collecting of fern varieties[1] had a fever of enthusiasm which, within a decade or so, somewhat stifled itself with disgust at the number of grotesque abnormalities which were being perpetuated. In the latter part of the nineteenth century enthusiasm revived when collectors were more selective, resulting in the formation of fern societies, the making of fine collections and a spate of literature. Interest dwindled again at the beginning of the twentieth century, but today there is another revival, particularly in this country and the United States of America.

In this short paper I want to consider cultivated ferns from the standpoint of societies and institutions and on national and international levels; also the contribution of the British Pteridological Society.

HORTICULTURAL SOCIETIES often have some interest in ferns, although most of them, including the Royal Horticultural Society of London, have so far not received enough support from their membership to set up fern committees. Societies of fernlovers are few and include the American Fern Society, the British Pteridological Society, and the Nippon Fernist Club. Their journals contain a wealth of information; the first fifty numbers of that of the latter are in Japanese and in 1961 they were planning to publish in English or with English summaries.

BOTANICAL INSTITUTIONS usually try, in one way or another, to take an interest in cultivated plants. An institution may have no relevant books or specimens at all, its staff relying on personal experience. On the other hand it may concentrate primarily on cultivated plants, outstanding examples being the Bailey Hortorium at Ithaca, New York and the Royal Horticultural Society of London whose Lindley Library is one of the finest collections of literature on this subject. The majority of institutions fall between these extremes, some places being more fortunate than others in possessing the herbaria of famous pteridologists, although few have herbaria containing important fern varieties such as, for example that of Thomas Moore at Kew.

At NATIONAL levels cultivated ferns come under review by horticultural societies and they are usually included in encyclopedias of gardening. Laws of copyright and patent apply in most countries but the introduction

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[1] *variety* and *cultivar* (see p. 180.).

of special bills for their application to plant breeders is rare; the United States of America has had such rights for thirty years. In her speech on the opening of Parliament in November 1963, Her Majesty the Queen said " Legislation will be introduced to promote the well-being of horticulture. Proposals will also be made to enable rights to be conferred on breeders of new varieties of plants". She was referring to a Parliamentary Bill[2] to create a system of proprietary rights for breeders and discoverers of new varieties of plants, to establish a Plant Variety Rights Office with a tribunal (a panel of biologists and plant specialists under the chairmanship of a lawyer), an Index of names of plant varieties and a Gazette. This Bill replaces and extends in scope the Seeds Act 1920 and relevant parts of other Acts are restricted. Plantbreeders' rights, in respect to plant varieties, are available to the first applicant (or his successor in title) who himself bred or discovered the variety, and are to be exercisable for 15 years (extendable to a maximum of 25 years). The Bill follows international agreement in requiring that a variety must be clearly distinguishable from any other variety whose existence is a matter of common knowledge at the time of the application, common knowledge being established by reference to plant varieties already in cultivation or exploited for commercial purposes, or those included in a recognised commercial or botanical reference collection, or those of which there are precise published descriptions.

INTERNATIONALLY there is the International Society for Horticultural Science which publishes *Chronica Horticulturae*. The desire to classify and give names is universal[4]. It was not until the nineteenth century, however, that international attempts were made to achieve uniformity in the naming of plants[5], although rules of nomenclature for certain groups of cultivated plants had been made by societies long before. The first code of botanical nomenclature was published in 1867 and it has been revised several times, the latest being the *Botanical Code*[6] of 1961. It was not until 1953 that a separate *Code for cultivated plants* appeared; it was revised[7] in 1956, and the second, latest revision[8] was published in 1961.

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[2] *Plant varieties and seeds bill.* Her Majesty's Stationery Office, London, 19th December 1963. price 3s 6d.

[4] J. S. L. GILMOUR, 1961. A decade of nomenclature, *Bull.Alpine Garden Soc.* 29:53-61
ELSPETH M. HARRIS, 1963. What's in a name, *Bull.Hardy Plant Soc.* 3:44-46.
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[5] W. T. STEARN, 1953. Historical introduction, *International code of nomenclature for cultivated plants.*

[6] *International code of botanical nomenclature.* Adopted by the Ninth International Botanical Congress, Montreal August 1959. Published as volume 23 of *Regnum vegetabile*, Utrecht, December 1961, by the International Association for Plant Taxonomy with financial aid from I.U.B.S.-U.N.E.S.C.O.

[7] The full text of the 1956 *Code for cultivated plants* is reprinted in the R.H.S. *Dictionary of gardening, Supplement.*

[8] *International code of nomenclature for cultivated plants.* Formulated and adopted by the International Commission for the Nomenclature of Cultivated Plants of the International Union of Biological Sciences. Published as volume 22 of *Regnum vegetabile*, Utrecht, June 1961. Obtainable from the Royal Horticultural Society, Vincent Square, London, S.W.1, price 2s. 6d., post free.

A cultivated plant may be referred to by using three kinds of names; e.g., Ladyfern *Athyrium filix-femina* ' Druery ' comprises a common (vernacular) name, a botanical name, and a varietal name. The common name in any language is governed by popular usage. The botanical name is always in latin, consists of a generic name followed by a specific epithet, and is governed by the *Botanical Code*. The varietal epithet is governed by the *Code for cultivated plants*.

Confusion in the nomenclature of cultivated plants has been caused mainly by the indiscriminate use of both latin and vernacular varietal names. In ferns, most varietal names have been composed of several latinised epithets which, fortunately, may be adapted for presentday use.

The following points from the *Code for cultivated plants* seem appropriate to be mentioned here:

Variety (not to be confused with *varietas*[9]) is synonymous and interchangeable with *cultivar;* for ferns, however, it seems desirable to continue using *variety*, which can be one of four kinds of unit. Ideally, a variety is a clone (vegetative progeny from a single individual); it can also be a line (uniform seed- or spore-progeny); or an assemblage involving minor gene differences; or an assemblage of uniform first generation hybrids.

The name of a variety. From 1 January 1959, a new varietal epithet should be a fancy name markedly different from a scientific name of latin form, consist of up to three words, each spelt with a capital initial letter (except when national custom demands otherwise) and enclosed within single quotation marks; it should agree in gender with the genus concerned and can precede or follow the botanical or the common name. Thus, *Athyrium filix-femina* ' Victoriae '; had this variety been described after 1958 a suitable name could be *Athyrium filix-femina* ' Queen Victoria ' or ' Queen Victoria ' Ladyfern; similarly, after 1958, ' Frizelliae ', 'Padleyi', 'Cathedrale' could be ' Mrs Charles Frizell ', ' Reverend Charles Padley ', ' Lichfield Cathedral '.

Change of scientific name leaves the varietal epithet unchanged, e.g., *Scolopendrium vulgare* ' Hookeri ' becomes *Phyllitis scolopendrium* 'Hookeri'; likewise variety ' Barnesii ' of *Lastrea montana*, *Dryopteris oreopteris* or *Thelypteris limbosperma*, etc.

Inadmissable names. Since 1958 it has not been permissible to introduce the following kinds of fancy names for new varieties: the botanical or common name of a genus or the common name of a species, e.g., Camellia ' Rose ', since this could be carelessly referred to as rose ' Camellia '; a combination of parts of the latin names of the parent species when the

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[9] *varietas* is a botanical category between *species* and *forma*.

variety is of hybrid origin; names including the word " variety " (or "var.") or " form "; translated personal names, e.g., ' Charles ' must not be altered to ' Karl ', ' Karel ', etc. Also, the avoidance is recommended of nine further kinds of fancy epithet, such as names beginning with abbreviations (except *Mrs* and its equivalent in other languages), those lending themselves to confusion, exaggeration or vagueness and (unless required by national custom) names containing numerals, symbols, an initial article (e.g., *The*), forms of address (e.g., *Miss* and *Mister* and equivalents in other languages are rejected; *Mrs*, *Madame*, *Frau* and other equivalents are admissible).

The correct name of a variety is, with few exceptions, the earliest available legitimate name.

Legitimate variety names are those validly published in accordance with the Articles of the *Code for cultivated plants*. Names contrary to Recommendations of the *Code* are not on that account illegitimate. Names given before 1959 must either be validly published or accepted by an official registration authority; a description or a reference to a previously published description is desirable but is not necessary. Names given after 1958 must be validly published and also accompanied by a description (in any language) or by a reference to a previously published description. Recommendations are that English, French, German, Russian or Spanish be used for a description, that an illustration be provided, and that a preserved specimen and/or illustration (preferably coloured) be deposited in a public herbarium and be cited in the description.

Valid publication is effected by the distribution to the public of printed or similarly duplicated matter. Microfilm, microcard and xerograph are accepted. Handwritten material (even though reproduced by mechanical or graphic processes) and non-technical newspapers are excluded.

Registration is the acceptance of the name of a cultivated plant or group of plants by a registration authority and the inclusion of this name in a register. There is no such register at present for ferns.

A registration authority is any international or national organization or agency so designated either by appointment or by mutual agreement of societies, organizations and agencies interested. Its main function is to compile and publish lists, with descriptions and historical details, of varieties in cultivation and of defunct but historically important varieties. The British Pteridological Society is preparing revised lists of the names of cultivated ferns[10]; such work may result in the recognition of an official registration authority. To help in this work we are considering making a survey to enlist the utmost collaboration among societies interested in registration. Published

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[9] a list compiled by J. W. Dyce of ferns to which Certificates of Merit have been awarded by the British Pteridological Society is given on page 183.

treatments of cultivated ferns, such as those in the *American Fern Journal* and the *British Fern Gazette* and lists such as in encyclopedias of gardening and in *Standardized plant names* by the American Joint Committee on Horticultural Nomenclature, are of great help in this work; the Editor hopes for more contributions similar to the treatment of *Polystichum* in the last *Gazette*. As another aid in the registration project we are preparing a census of fern varieties growing in the British Isles.

Description. A variety, like other taxonomic groups, should be described definitively, i.e. so that other plants may be readily compared. Ideally, such a description should be supplemented by a coloured illustration and backed up by preserved material. Seldom do we have this ideal. The British Pteridological Society is planning to define each fern variety by publishing illustrated descriptions.

THE BRITISH PTERIDOLOGICAL SOCIETY. In his presidential address to the sixtieth Annual Meeting of the Society in 1963, Reginald Kaye asked: " What is going to happen to all the varieties of ferns in cultivation today, hundreds less than fifty years ago; what is going to be the position in the future?"

Our plans include a survey of societies interested in ferns and a census of ferns cultivated in the British Isles, publishing treatments of relevant genera and illustrated descriptions of varieties, compiling lists of varieties for registration and distributing living material to gardens in the British Isles, thereby seeking to increase the popularity and chances of survival of our heritage of fern varieties.

FERN VARIETIES TO WHICH *CERTIFICATES OF MERIT* HAVE BEEN AWARDED BY THE *BRITISH PTERIDOLOGICAL SOCIETY*

Compiled by J. W. Dyce

The names are those under which the certificates were awarded (with dates) and are subject to revision

Asplenium trichomanes inciso-crispum Clement 1921.

Athyrium filix-femina caput medusae 1938; cruciato-cristatum baccatum Kingsmill Moore 1922; plumoso-cristatum Lovelady 1930; plumosum laxum Sheldon 1931; setigerum percristatum Sheldon 1929.

Blechnum spicant bipinnatum Sheldon 1931; percristatum Rowlands 1926; ramo-cristatum Blow 1927; Smithies seedling 1938; tricapitatum 1904.

Lastrea dilatata (=**Dryopteris dilatata**) grandiceps Cranfield 1938.

Lastrea filix-mas (=**Dryopteris filix-mas**) cristato-tenuis Parker 1932; grandiceps C. Henwood 1924.

Lastrea montana (=**Thelypteris limbosperma**) formoso-cristata F. W. Stansfield 1922; grandiceps Smithies 1903.

Lastrea propinqua (=**Dryopteris abbreviata**) crispa Cranfield 1939.

Lastrea pseudo-mas (=**Dryopteris borreri**) fimbriato-cristata angustata Cropper 1922; polydactyla Whiteside 1929, Whitwell 1922.

Polypodium vulgare bipinnatum F. W. Stansfield 1926; cambricum Henwood 1922; cristatum Henwood 1922; omnilacerum 'Oxford' 1921; plumosum Whilharris 1927; pulcherrimum congestum Perry 1928.

Polystichum aculeatum cristatum Henwood 1927; divisilobum Cranfield 1927; folioso-incisum Sheldon 1933; gracillimum attenuatum Druery 1938; g. cristulatum Cranfield 1937; g. pulcherrimum Cranfield 1937; grandiceps Sheldon 1937; pulcherrimum Cranfield 1927, Druery 1921, Kingsmill Moore 1934; p. foliosum Edwards 1922; p. plumosum Green 1921; sinuosum Kingsmill Moore 1931.

Polystichum angulare (=**P. setiferum**) acutilobum Stansfield 1927; a. divisum F. W. Stansfield 1930; a. laxum Sheldon 1934; a. macrodon T. Stansfield 1930; a. polydactylum Kingsmill Moore 1930; congestum perserratum Perry 1924; decompositum dissectum Perry 1926; divisilobum Bland 1922; d. discretum Clapham 1937; d. falcato-pinnulum 1923; d. falcatum 1923; d. foliosum variegatum Harris 1921; d. pallens Sheldon 1937; d. perserratum Phillips 1928; d. plumosum Baldwinii 1923; d. p. erectum H. Stansfield 1921; d. venustum 1923; foliosum Moly 1927; f. grande Walton 1922; inciso-setosum Sheldon 1934; lineare caudatum T. Stansfield 1928; l. cristatum Ed. 1906; multilobum Sheldon 1934; m. rotundatum Benbow 1927; percristatum Cranfield 1921; p. grande Cranfield 1927; perserratum grandiceps Askew 1931; pluma-Struthionis F. W. Stansfield 1926; plumosum elegans Sheldon 1937; p. rarefactum H. Stansfield 1921; pulcherrimum Cranfield No 1 1925, F. W. Stansfield 1922, H. Stansfield No 4 1925, No 5 1938; p. 'Moly's Green' 1927; p. variegatum 1928; rotundatum Phillips 1927; tripinnatum Meade 1925; t. grande Kingsmill Moore 1930.

Scolopendrium vulgare (=**Phyllitis scolopendrium**) crispissimum muricatum 1938; crispum angustifrons Sheldon 1937; c. cristatum John Cousins 1927; c. fimbriatum muricatum Lowe 1921; c. f. sagittatum Sheldon 1930; c. sagittatum Sheldon 1931; c. speciosum Moly 1921; c. splendens Moly 1927; laceratofimbriatum Sheldon 1930; laceratum grande 1931; ramo-cristatum Cranfield 1937; sagittato-crispum cristatum Perry 1926.

DISTRIBUTION OF THE BRITISH FERNS AND THEIR ALLIES

During 1962 the *Atlas of the British flora** was produced by the Botanical Society of the British Isles. This contains over 1600 small outline maps of the British Isles, showing the distribution of about 1700 species of native or naturalised plants including ferns. The Ordnance Survey grid system was utilised, and dots indicate the presence of the plants in the relative 10-kilometre squares. This of course does not show the complete picture, as a dot recorded on a map cannot show whether the plant exists in a square as an individual specimen only, or is abundant throughout the area. It is extremely interesting to study the distribution pictures of the ferns and many cases show the lack of interest in the Pteridophyta which seems to prevail among botanists generally. It is very obvious that a lot of work has still to be done on fern distribution and the *Atlas* has acted as a spur to do something about it.

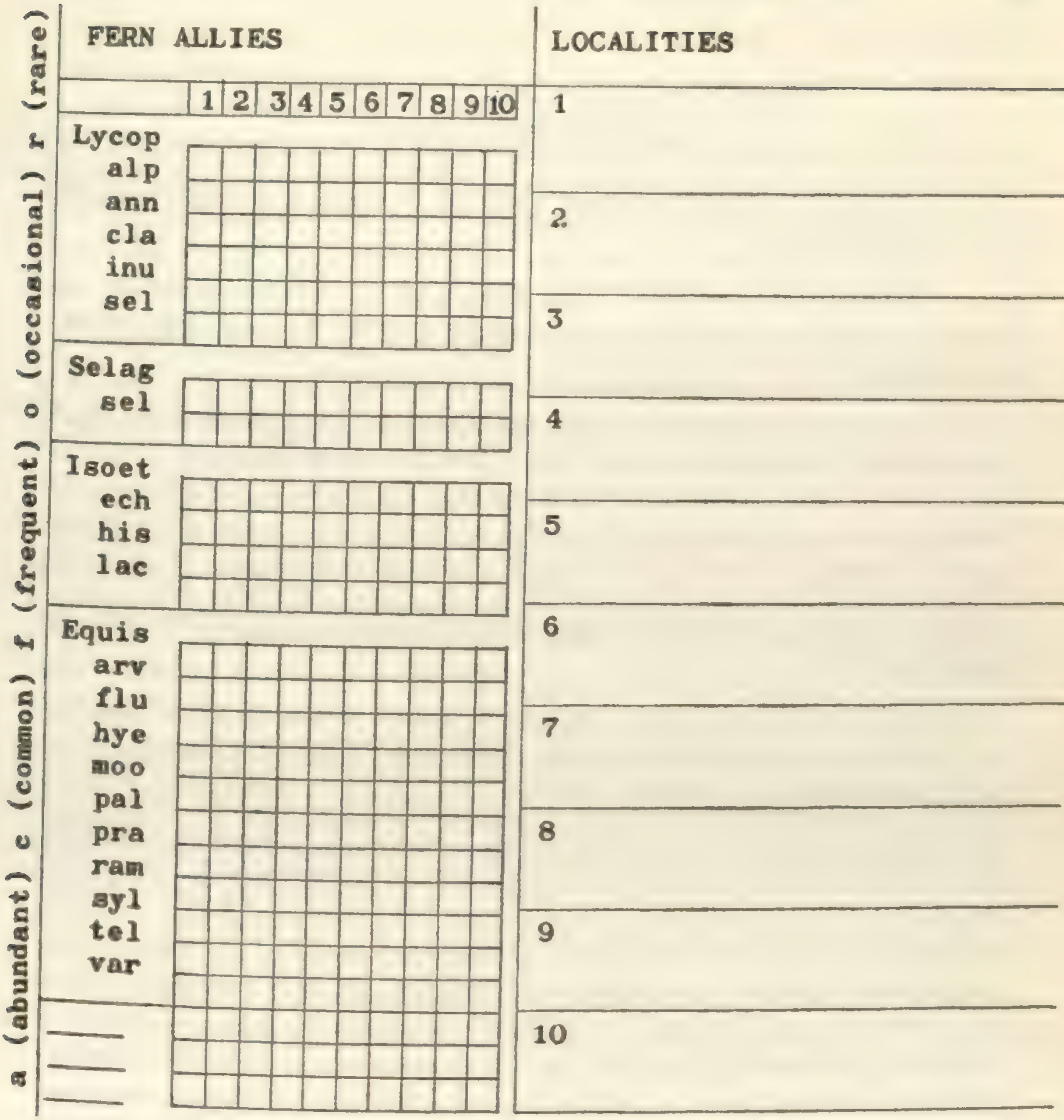
BRITISH PTERIDOLOGICAL SOCIETY

DISTRIBUTION CARD FOR FERNS AND FERN ALLIES

COMMON	1	2	3	4	5	6	7	8	9	10
Asple adi										
rut										
tri										
vir										
Athyr fil										
Blech spi										
Ceter off										
Crypt cri										
Cysto fra										
Dryop abb										
aem										
bor										
car										
dil										
fil										
(agg)fil										
Gymno dry										
rob										
Osmun reg										
Phyll sco										
Polyp aus										
int										
vul										
(agg)vul										
Polys acu										
set										
Pteri aqu										
Thely lim										
phe										

UNCOMMON	1	2	3	4	5	6	7	8	9	10
Adian cap										
Anogr lep										
Asple alt										
bil										
mar										
sep										
Athyr dis										
fle										
Azoll fil										
Botry lun										
Cysto dic										
mon										
Dryop cri										
uli										
vil										
Hymen tun										
wil										
Ophio lus										
vul										
Pilul glo										
Polys lon										
Thely pal										
Trich spe										
Woods alp										
ilv										
_____										
_____										
_____										
_____										

* *Atlas of the British flora*. Ed. F. H. Perring & S. M. Walters. Pp. xxiv + 432. B.S.B.I. & Thomas Nelson & Sons Ltd, London & Edinburgh, 1962. Five guineas.



I have devised a card as shown above, and use a separate one for each 10-kilometre square. Filed according to squares this system works admirably for quick reference and gives a clear picture for any area under review. Cards could of course be used for any unit area. Also, instead of a tick in the locality box one could put a symbol indicating the frequency, e.g. a (abundant), c (common), f (frequent), o (occasional), r (rare).

It is thought that many members of the Society are gathering information on the fern distribution in their home districts or when on holiday in other parts of the country. I shall be pleased to hear from anyone interested in using these cards and if the demand is sufficient to cover the costs the Society will consider bulk printing. It is hoped that some will be available at this year's Excursion.

J. W. DYCE

BRITISH PTERIDOLOGICAL SOCIETY
MEETINGS IN 1963

BRITISH MUSEUM (NATURAL HISTORY), LONDON, 9 February. Conversazione and exhibition meeting.

ROYAL HORTICULTURAL SOCIETY'S GARDENS, WISLEY, SURREY, 18 May. An excursion to see, amongst others, the remnants of W. B. Cranfield's British fern varieties.

BROCKENHURST and LYNDHURST, HAMPSHIRE, 14–16 June. Among 18 species of ferns seen, of particular note were *Ophioglossum vulgatum*, *Osmunda regalis* and *Pilularia globulifera*. We hunted in vain for *Polystichum setiferum*, although it is recorded for the area and is most abundant a few miles further south.

NATIONAL PINETUM, BEDGEBURY, KENT, 7 July. A meeting jointly held with the Kent Field Club.

ROYAL BOTANIC GARDENS, KEW, SURREY, 27 July. A visit to the Herbarium and Library conducted by Dr Frances M. Jarrett. After lunch a tour of the Gardens with Mr H. J. Bruty.

THE ANNUAL EXCURSION, 15–21 September. Pencerrig Country House Hotel a pony-trekking station about two miles north of Builth Wells on the border of Breconshire and Radnorshire turned out to be an excellent centre. Mention has been made before of the added interest the *Atlas of the British flora* gives to our records; our Secretary has developed a most efficient system (see p. 184) whereby he is able to recognise straightaway a new record for a 10 kilometre square (a new dot for the appropriate *Atlas* map). Permits had been obtained to enter and collect in six Nature Reserves; new fern records were made in all of these, and details of our observations have been sent to the Nature Conservancy.

On Sunday we worked down the Wye valley to Clyro and returned via Painscastle. The first stop was at Aberedw to inspect a steep wooded bank of northerly aspect with cliffs rising above a stream, which was typical of good fern ground in the district; within half-an-hour we had found 15 species including 2 new records. We then visited a similar site at Erwood where an additional species, *Gymnocarpium dryopteris*, was found in plenty. The next stop was at a bridge with a fine display of *Asplenium trichomanes*, large sprays of *Cystopteris fragilis*, and interesting Polypods, some with forked pinnae. A mile north of Glasbury we explored a wooded gorge where *Polystichum setiferum* and *Phyllitis scolopendrium* were the dominant ferns, which is remarkable since neither of these is plentiful in this part of the country. Crossing a field on the way we noted silvery bushes of *Artemisia*

absinthium which proved to be a new record. At Clyro we turned off the main road and went over the hill to a bog known as Rhosgoch Common*. Mr and Mrs Walter Jones, proprietors of a local guesthouse, told us that *Osmunda* grows in a wood at the far end but that it is decreasing; unfortunately time did not allow us a visit to this remote spot, but it was some compensation to discover *Pilularia globulifera;* many other bog plants were found, such as *Potentilla palustris* and *Senecio aquaticus* which was still in flower. The first day's hunting had yielded 18 fern species, including 4 new records.

On Monday we went to Llandovery and turned north up the valleys of the Tywi and Doethie rivers to visit the Nature Reserve known as Allt Rhyd-y-groes. Up a steep and beautiful mountain stream we found 11 ferns including 2 new records; this stream is noted for uncommon bryophytes. North of the stream a Sessile Oak wood, typical of the region, forms part of the Reserve; the broad dark-green leaves of the *Quercus petraea* give deep shade which, where there is ample surface water, induces a most luxuriant undergrowth of ferns but, where the soil is dry, the undergrowth is mainly composed of Bilberry. After lunch we went further up the valley to some cliffs where *Cryptogramma crispa* had been recorded in 1958 at almost the extremity of its southern range; since this was no part of the Reserve we asked permission and were given every assistance to reach our objective; we failed to find the Parsleyfern but we did discover a plentiful growth of *Hymenophyllum wilsonii* by a stream cascading down the steep hil lside; this filmy fern was recorded several times during the week and we wi*ll* make no further special mention of it.

Tuesday was spent at Craig-y-cilau N.R. near Crickhowell. This is an extensive line of cliffs and old quarry-workings on Carboniferous limestone which underlies the South Wales coalfield syncline and outcrops around its periphery. The remains of a tramtrack provides a path along the Reserve and easy access to the cliffs and screes at any point. *Gymnocarpium robertianum*, in varying shades from green to red, was abundant in screes where Oakfern and Beechfern were also found. In rock crevices were *Asplenium ruta-muraria*, *A. viride*, *Ceterach officinarum* and *Phyllitis scolopendrium*. At the top of the cliffs, in complete contrast, *Blechnum spicant* thrived on the overlying acid moorland.

On Wednesday, the only wet day, we went to some waterfalls two miles northwest of Rhayader. Access to these was difficult and approach had to be from above, over a mile of boggy moorland where we found *Lycopodium alpinum* and *L. clavatum*, which are uncommon in this region, and *Hypericum elodes*, a new record. The waterfalls were worth the visit and 10 ferns were found in the wooded oasis surrounding them, but after trudging back across

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* for ecology, pollen analysis, and stratigraphy of Rhosgoch see D. B. BARTLEY 1960, *New Phytologist* 59:235-262, *J. Ecol.* 48:205-214.

the moor in the rain it was agreed to call it a day. However, a small group had decided to by-pass the waterfalls and continue along the mountain road to Devil's Bridge; they escaped the rain and found plentiful ferns; at one of their four stops were two plants of *Cryptogramma crispa* in boulder scree.

The following day we went south to Craig Cerrig Gleisiad N.R. which lies in the Brecon Beacons National Park. This is on the Old Red sandstone which gives rise to an extensive area of bleak moorland mountain country. The Reserve is named after a horseshoe of cliffs some 600 feet high which form its principal feature. These supported a luxuriant vegetation of interesting plants, including *Asplenium* and *Polystichum*, while the screes below were dominated by *Dryopteris borreri* among other ferns, including a few *D. abbreviata*. Six new records were soon made and it is remarkable that *Thelypteris limbosperma* which was the commonest fern over considerable areas had not been recorded for this well-botanised locality. The site is noted as the southernmost station of a number of arctic alpine plants; none of these was in flower at the time but we noted cushion saxifrages and, high on the cliffs, an old record for *Saxifraga oppositifolia* was confirmed. After lunch the main party decided that there was still plenty of ground to explore around the cliffs, while two small parties set off to other cliffs, one over moorland to the west and the other down the road to the south; the former had all the fern species of the main cliffs and at the latter *Cryptogramma crispa* was found on scree.

On Friday we went via Llanwrtyd Wells to Abergwesyn where, in the neglected churchyard wall, were hundreds of plants of *Asplenium ruta-muraria* and *Ceterach officinarum*, one plant of Ceterach being identified as a 'Crispum' form. We then visited Nant Irfon N.R. which is in a similar situation to Allt Rhyd-y-groes but is more open and varied. After lunch the main party took the mountain road to Tregaron to visit the extensive and famous raised bog. A smaller party exploring the valleys north of Beulah found that if the scenery was less exciting this did not apply to the fern flora. At the first stop an unexpected find was *Equisetum sylvaticum*, one of the very few horsetails found during the week. Then, in a disused slate quarry a fine colony of *Asplenium adiantum-nigrum* was found. A bridge on the B4358 road was seen to have iron railings and was nearly passed by; however, on stopping, no less than 9 species of ferns were found growing on or very close to the bridge, including luxuriant *Cystopteris fragilis*, quantities of Ceterach and even Oakfern. Finally, a halt was made at a hillside oakwood which, although festooned with lichens, turned out to be dry and fernless; however, in marshy ground at the bottom of the wood the last find was our first *Dryopteris carthusiana*.

Saturday was the day of home-goings. Nevertheless one party went to Cwm Clydach N.R. which is on the Carboniferous limestone and proved

most interesting. At the bottom was a dark ravine with luxuriant fern growth, including *Polystichum aculeatum* and *P. setiferum*. Higher up was a disused railway track in the ballast of which were found plentiful *Gymnocarpium robertianum* and Ceterach, while in the brickwork of a tunnel entrance was a magnificent display of *Cystopteris fragilis*. In boulder screes were found more Ceterach and *Asplenium trichomanes*, and on limestone cliffs were *A. adiantum-nigrum* and *A. ruta-muraria*. *Blechnum spicant* grew in acid pockets in the higher gullies. In all, 17 fern species were found by late afternoon, although only half the area had been covered. Another party visited two more limestone localities, the first of which was a noted beauty-spot near Ystradfellte with waterfalls and potholes; some good ferns were found, including *Phyllitis scolopendrium* growing in the deep shade of cavemouths; *Mimulus guttatus*, which is increasing in South Wales, was recorded in full flower beside the river. The second site was Penmoelallt Forest N.R., which is a wood on a very steep slope topped by cliffs overlooking the River Taff on the northern outskirts of Merthyr Tydfil; this was not a particularly ferny spot and the complete absence of *Thelypteris limbosperma* may perhaps be attributed to atmospheric pollution; it is of interest for its rare trees, including *Sorbus leyana* of which only a few bushes remain.

During the week a great deal of interesting and varied ground was seen; 103 Polypods were collected for a survey which has segregated them to 86 *P. vulgare*, 15 *P. interjectum*, and 2 presumed pentaploid hybrids. Our experience with the *Atlas of the British flora* has shown, at least for ferns, that the frequency of dots on the maps may be more indicative of the distribution of botanists. We should therefore not be deterred from visiting a region merely because the *Atlas* shows a poor fern distribution; in fact it is in such regions that we may be able to contribute most.

Appended is a list of pteridophytes seen during the Excursion; figures (**bold**= new record for the *Atlas*) refer to localities.

Lycopodium clavatum — *19*
L. alpinum — *19*
Equisetum palustre — *4*
E. sylvaticum — *15*
Hymenophyllum wilsonii — **2, 4, 6, 20,** *28, 30, 31*
Pteridium aquilinum — *2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 18, 19, 20, 21, 23, 24, 28, 29, 30, 31, 33*
Cryptogramma crispa — **4, 33**
Blechnum spicant — *2, 3, 4, 5, 6,* **7,** *9, 10, 11, 19, 20, 21, 22, 28, 29, 30, 33*
Phyllitis scolopendrium — **5, 7,** *9, 10, 12, 14, 15,* **16,** *21, 22.*
Asplenium adiantum-nigrum — *9, 11, 21*
A. trichomanes — *1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14,* **16, 17,** *18, 21, 22, 23, 28, 30*
A. viride — **4, 5, 6,** *7*
A. ruta-muraria — **1,** *7, 8, 9, 11, 13,* **16,** *18, 21, 22, 23, 32*
Ceterach officinarum — *1, 7, 8, 9, 11, 12, 22*
Athyrium filix-femina — *1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 28, 29, 30, 31, 33, 34*

Cystopteris fragilis — **4, 5, 6,** *7, 9, 10, 12,* **14, 16, 17,** *18, 21,* **29, 30**
Dryopteris filix-mas — **1, 2, 3, 4, 7, 9,** *10,* **11, 12, 14, 15, 16, 18, 21, 22, 23, 24, 28, 29, 30, 32, 33, 34**
D. borreri — *2, 4, 5, 6. 7, 9, 10,* **11, 14, 15, 16, 18,** *19,* **20, 21, 22, 23,** *28, 29, 30, 31, 32,* **33, 34**
D. abbreviata — **4**
D. carthusiana — **3**
D. dilatata — *2, 3, 4, 5, 6, 7, 9, 10, 11, 12,* **14,** *15, 16, 19, 20, 21, 22, 23, 24, 28, 29 30, 31, 33, 34*
Polystichum setiferum — *9, 10,* **14, 21, 22, 29**
P. aculeatum — **4, 6,** *9, 10,* **16,** *18, 21, 28,*
Gymnocarpium dryopteris — **2, 4, 6, 7,** *10,* **12,** *19,* **20,** *30.*
G. robertiana — *7, 9*
Thelypteris limbosperma — *1, 2, 3,* **4, 5, 6, 7, 9,** *10, 11, 15,* **16,** *19, 20, 21, 22, 28, 29, 30, 31, 34*
T. phegopteris — **2, 4, 5, 6, 7, 11,** *19,* **20,** *28, 29, 30, 33*
Polypodium vulgare — *2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15,* **16, 17,** *18, 19, 20, 21, 22, 23, 24,* **26,** *27,* **28,** *29, 30, 31, 33*
P. interjectum — *7, 10, 11, 14, 21,* **28**
P. interjectum × vulgare *11, 21.*
Pilularia globulifera — **25**

		Date visited	*National Grid Ref.*
V.C. 42 Brecknockshire (*O.S. 1" map ser. 7, sheet 140*)		*September*	
1	ABERGWESYN Church	20	**22**/ 8552
2	NANT IRFON N.R. 1 mile NE of Abergwesyn ... (*O.S. sheet 141*)	20	8453
3	COED-Y-CILIAU 2½ miles NE of Beulah ...	20	9553
4	CRAIG CERRIG-GLEISIAD N.R. 6 miles SW of Brecon	19	9621, 9622, 9722
5	CRAIG-Y-FRO 1½ miles S of Craig Cerrig-gleisiad	19	9720
6	CWM DU 2 miles W of Craig Cerrig-gleisiad ...	19	9421
7	CRAIG-Y-CILAU N.R. 2 miles SW of Crickhowell	17	**32**/ 1915, 2015, 2016
8	CRICKHOWELL — Bridge over Usk	17	2118
9	CWM CLYDACH N.R. 1½ miles E of Brynmawr	21	2112, 2212
10	ERWOOD — wooded ravine	15	0942
11	GILWERN 1½ miles N of Beulah	20	**22**/ 9153
12	GLANDULAS Bridge over Dulas 2 miles NE of Beulah	20	9453
13	LIBANUS 3½ miles SW of Brecon	19	9925
14	LLANGOED CASTLE, roadside at bridge ...	15	**32**/ 1139
15	LLWYN MADOC 1½ miles NW of Beulah ...	20	**22**/ 9052
16	PORTH-Y-OGOF 1 mile S of Ystradfellte ...	21	9212
17	YSTRADFELLTE ... ... (*O.S. sheet 154*)	21	9213
18	PENMOELALLT N.R.	21	**32**/ 0109
V.C. 43 Radnorshire (*O.S. sheet 128*)			
19	CRAIG-DDU 2 miles NW of Rhayader ...	18	**22**/ 9469
20	NANT-Y-SARN WATERFALLS 3 miles NW of Rhayader ... ... (*O.S. sheet 141*)	18	9371
21	ABEREDW — wooded ravine	15	**32**/ 0847
22	CILKENNY DINGLE 1½ miles N of Glasbury ...	15	1840, 1841
23	PENCERRIG COUNTRY HOUSE HOTEL 2 miles N of Builth Wells	14–21	0453
24	RHOSGOCH	15	1847
25	RHOSGOCH COMMON bog	15	1948

V.C. 46 Cardiganshire				
(*O.S. sheet 127*)				
26	BLAEN-Y-CWM bridge over river 6 miles E of Devil's Bridge	18	**22**/ 8275	
27	BRYN 3 miles SE of Devil's Bridge	18	7774	
28	DEVIL'S BRIDGE and Mynach Falls	18	7477	
(*O.S. sheet 140*)				
29	ALLT RHYD-Y-GROES N.R. 6½ miles W of Llanwrtyd Wells	16	7647, 7747	
30	CRIBYN DU 1½ miles NE of Allt Rhyd-y-groes N.R.	16	7548, 7648	
31	JUNCTION OF AFON DOETHIE and AFON TYWI 6 miles W of Llanwrtyd Wells	16	7746	
32	TREGARON, railway bridge 1 mile N of ...	20	6861	
V.C. 46/47 Cardiganshire/Montgomeryshire border				
(*O.S. sheet 127*)				
33	CRAIG-Y-LLUEST (V.C. 46)	18	8575, 8576	
34	CRAIG-Y-LLUEST south of stream by roadside (V.C. 47)	18	8575	

ANNUAL GENERAL MEETING, 18 September. Held during the Annual Excursion. Reported in *Newsletter* No. 1, November 1963, to which were appended Minutes of this sixtieth A.G.M. and the President's talk.

BORROWDALE and COCKERMOUTH, CUMBERLAND and RYDAL, WESTMORLAND, 5 and 6 October. Eight people attended this Northern weekend meeting during which twenty fern species were recorded.

BRITISH MUSEUM (NATURAL HISTORY), LONDON, 19 October. Conversazione and exhibition meeting.

THE SOUTHPORT FLOWER SHOW 28 - 30 August 1963

Our President, Mr. Reginald Kaye, judged the fern exhibits this year with Mr. W. G. Mackenzie (Curator of Chelsea Physic Garden). Each fern had to be assessed carefully for rarity, cultivation, presentation and condition, and it was exceedingly close between first and second in many cases. There was evidence of more care in preparation, one exhibitor in particular having taken great pains in cleaning his pots and neatly surfacing them with nice fresh moss. Dressing a plant for exhibition means a good deal and may make just that little extra when being judged. There were still one or two specimens marred by not removing weeds when potting them; this should never happen.

In Class 16, several exhibits were noted for having one fine specimen supported by two which looked as though they had recently left the bottom of a hedge. One contained what was probably the best specimen in the Show, but was supported by two such rough ones that the first had to go to a group of more uniform merit. The best possible fern in such a group cannot earn more than a third of the points and will not " pull up " inferior companions.

The ground group (Class 8) as usual was very well done and contained some magnificent specimens in splendid condition particularly, amongst many others, *Athyrium filix-femina* ' Clarissima ' and varieties of *Polypodium vulgare*.

The classes for greenhouse ferns seemed to be better than last year and some really delightful well-grown specimens were shown. Incidentally, some ferns shown as greenhouse subjects were hardy ones. The Show Schedule should indicate that ferns shown in these classes should be tender species requiring greenhouse conditions. In the judges' view, the inclusion of hardy species in classes for greenhouse ferns would have to be taken into account in the event of more numerous entries as, strictly speaking, they are not " according to schedule " and, indeed, we had some discussion as to whether we could overlook the offenders.

Thanks are due to Messrs Almond, Hayhurst, Jackson and Robinson for staffing the Society's Information Bureau. Any assistance members can give in this direction will be greatly appreciated.

A glance over the following list of prizewinners and their entries shows the selection of ferns available for visitors to see. Except for a few abbreviations the fern names are those with which they were exhibited.

CLASS 8 A group of hardy British ferns, with accent on diversity and variation, arranged in a natural manner in a space 13 feet by 8 feet and not higher than 6 feet above the ground:

1st Messrs. J. Brookfield & Son who continue to hold the Silver Perpetual Challenge Trophy presented by the British Pteridological Society.

CLASS 9 Six dissimilar hardy British ferns with accent on variation:

equal 1st B. Hayhurst: *Athyrium filix-femina victoriae*, *Dryopteris lineata cristata*, *Phyllitis scolopendrium variegata*, *Polypodium pulcherrimum*, *Polystichum* ' Hirondelle ', *P. iveryanum*.

F. Jackson: *Athyrium filix-femina cristatum*, *Dryopteris lineata cristata*, *Osmunda regalis cristata* Moore. *Phyllitis scolopendrium marginata*, *Polypodium cambricum*, *Polystichum aculeatum grandiceps* Jones.

3rd Messrs Brookfield: *Athyrium filix-femina* Druery, *A.f.-f.fieldii*, *Dryopteris lineata cristata*, *Phyllitis scolopendrium variegata*, *Polypodium cambricum hadwinii*, *Polystichum aculeatum gracillimum*.

CLASS 10 Three distinct varieties of *Phyllitis scolopendrium:*

1st N. H. Almond: *bifida*, Bolton's *drummondii*, *ramo-marginata*.
2nd Messrs Brookfield: *cristata* (*2*), *undulata*.
3rd B. Hayhurst: *crispa*, ' Robinson's Broad ', *speciosa*.

CLASS 11 Three distinct varieties of *Polypodium vulgare:*

1st Messrs Brookfield: *cornubiense*, *grandiceps bifido-multifidum*, ' Oxford '.
2nd B. Hayhurst: *bifidum*, *cambricum hadwinii*, *pulcherrimum*.

CLASS 12 Three distinct varieties of *Polystichum:*

1st B. Hayhurst: *densum*, *divisilobum densum*, *iveryanum*.
2nd N. H. Almond: *divisilobum densum*, *imbricatum cristatum*, *pulcherrimum* Bevis.
3rd Messrs Brookfield: *aculeatum gracillimum*, *aculeatum pulcherrimum* Bevis, *setiferum*.

CLASS 13 Three distinct varieties of *Athyrium filix-femina:*

1st F. Jackson: *craigii*, *cristatum*, *nudicaule cristatum*.
2nd B. Hayhurst: *capitatum*, ' Druery ', *percristatum*.
3rd N. H. Almond: *capitatum*, *cristatum*, *frizelliae*.

CLASS 14 Three distinct varieties of *Dryopteris* (including *Gymnocarpium* and *Thelypteris*):

1st B. Hayhurst: *angustata cristata, lineata, ramosissima.*
2nd F. Jackson: *lineata cristata, polydactyla crouchii, polydactyla* Dadds.
3rd Messrs Brookfield: *lineata cristata, crispa cristata* Barnes, *cristata.*

CLASS 15 Three distinct varieties of *Asplenium*: [only distinct species were submitted].

1st F. Jackson: *alternifolium, septentrionale, viride.*
2nd N. Robinson: *ruta-muraria, septentrionale, trichomanes*
3rd Messrs Brookfield: *adiantum-nigrum, trichomanes, viride.*

CLASS 16 Three distinct normal species of hardy British ferns:

1st N. Robinson: *Cryptogramma crispa, Polypodium vulgare, Polystichum setiferum.*
2nd F. Jackson: *Asplenium trichomanes, Dryopteris lanceolatocristata, Woodsia ilvensis.*
3rd Messrs Brookfield: *Adiantum capillus-veneris, Cryptogramma crispa, Polypodium vulgare.*

CLASS 17 One British fern, any kind or variety:

1st Messrs Brookfield: *Athyrium filix-femina plumosum cristatum.*
2nd Mrs Wilkinson and Miss Austin: *Polystichum setiferum divisilobum.*
3rd F. Jackson: *Athyrium filix-femina frizelliae* × *fieldii.*

CLASS 18 Six dissimilar greenhouse ferns:

1st B. Hayhurst: *Adiantum cuneatum, Cyrtomium falcatum, Nephrolepis exaltata, Onychium japonicum, Platycerium alcicorne, Pteris cristata.*
2nd Messrs Brookfield: *Adiantum* 'Kensington Gem', *Asplenium bulbiferum* (2), *Davallia canariensis, Nephrolepis, Platycerium alcicorne.*

CLASS 19 Three dissimilar greenhouse ferns:

1st Messrs Brookfield: *Adiantum* 'Kensington Gem', *Davallia canariensis, Nephrolepis plumosa.*
2nd B. Hayhurst: *Adiantum cuneatum, Adiantum* 'Kensington Gem', *Nephrolepis exaltata.*

CLASS 20 One greenhouse fern:

1st B. Hayhurst: *Adiantum* 'Kensington Gem'.
2nd A. D. McCorie: *Adiantum cuneatum.*
3rd M. Plowman: *Adiantum cuneatum.*

R. KAYE, N. ROBINSON

BOTTLE GARDENS AND FERN CASES by Anne Ashberry, with illustrations by N. Creina Glegg. 120 pp., 33 photographs, 41 drawings. London; Hodder & Stoughton, June 1964. Price 25 shillings.

Following the theme of her earlier books on miniature gardening Miss Ashberry, whose Essex nursery specialises in dwarf conifers and alpine plants, describes her experiences with a variety of adaptations of the principle of the Victorian Wardian Case, including cider flagons, decanters and an antique wasp catcher, some arrangements (bottle gardens) being completely sealed and others (fern cases) having covers to allow changes, spraying, removal of dead flowers, taking of herbs for cooking, etc. She hopes to start a modern vogue which will be of immense joy and help to those who find more orthodox cultivation difficult or impossible.

Those of us who know the gentle charm of these two members of the British Pteridological Society and who have climbed with them in search of plant treasures, will realise that this book is a labour of love by real fern lovers.

J. A. CRABBE

NOTES FROM THE ROYAL BOTANIC GARDENS, KEW

GLEICHENIA: this genus consists mainly of tropical species that grow on waste or barren ground at the edges of forests, roadsides, etc., where they get a great deal of light. Such conditions seem easy to emulate in the hothouse but I find these ferns fail to make much growth if potted in rich fern compost. Instead, if put in bracken peat only, and given plenty of water, they will soon spread and cover the staging. They apparently dislike having their foliage cut, so any withered or dead frond is best left on the plant. *Gleichenia* may be raised from spore if sown within a week; for this reason the number of species in cultivation is small (only *G. linearis* at Kew).

TREE-FERNS: there is a tendency for some species which are easy to grow in the heated house, e.g., *Cyathea hookeri*, *C. sinuata*, to have weak trunks and fall over. If the trunk is covered with sphagnum moss held in place with wire netting, root production throughout the stem is increased and these bind together to help strengthen the trunk. Such plants do much better in open beds in the house rather than in confined tubs, and with a healthy root mat formed above ground they can always be cut off at ground level and lowered if the fronds are reaching the roof.

OPHIOGLOSSUM PENDULUM: a plant from Ceylon, on the roots of a Birdsnest Fern (*Asplenium nidus*), is now fruiting.

FERNERIES, KEW — H. J. BRUTY

WILLIAM CULLEN BUCHANAN

On 13 September last year died Willie Buchanan, the last of the family to farm Garscadden Mains, Bearsden, Dumbartonshire, for almost 150 years. He was born at the farm on 27 January 1887, and while there built an entrancing landscape rockery. Shortly after the Second World War, when most of the farmland was taken over for Glasgow development, he retired to a house nearby where he constructed a new half-acre garden.

Quite unique, a bachelor, an uncannily successful grower of very difficult plants, Member of the British Pteridological Society, the Alpine Garden Society, the Scottish Rock Garden Club and Fellow of the Royal Horticultural Society, he had been interested in plants all his life. Hundreds of thriving hardy plants, including rare ferns, were assembled in his beautiful new garden*, and one sincerely hopes his treasures have found good homes.

---

*For tributes and pictures of the Douglasbank garden, see *J. Scottish Rock Garden Club* 9(1) April 1964.

As a judge at the Shows of the Scottish Rock Garden Club his services were always in great demand. His unassuming generosity gave freely of his plants and advice to anyone interested and keen, although he found it difficult to suffer fools. He was most unwilling to put anything down in writing; it is believed that some of the early " Plant Notes " in the *Journal of the Scottish Rock Garden Club* were by him. " Some favourites " in 1954 (*loc.cit.* **14**:65, **15**:142) caused him considerable annoyance because the editor had inserted " by W.C.B."; the second part contains interesting short notes on a number of our rarer British ferns.

Willie will long be remembered with great affection by all who knew him. In his memory the Scottish Rock Garden Club has inaugurated an annual " William Buchanan Lecture " devoted to the cultivation of rare and difficult plants.

JAMES DAVIDSON, REGINALD KAYE

FREDERICK GEORGE PRESTON

My father, an Honorary Member of the Society, died at Cambridge on the 8th of January this year aged eighty-one, leaving a widow, two sons and a daughter.

Born at Warborough in Oxfordshire, his outstanding career in horticulture began in 1904 with training as a student gardener at the Royal Botanic Gardens, Kew. In 1909 he was appointed to the staff of the Cambridge Botanic Garden as Foreman-in-charge of the Outdoor Collection. From 1919–1947 he was Superintendent of the Garden. After his retirement he lived at Shelford on the outskirts of Cambridge where, until he became ill about two years ago, he continued his longstanding work with the Royal Horticultural Society, on committees and advisory panels, and as an examiner for the National Diploma of Horticulture.

His published work on horticulture includes books, articles in journals and contributions to the *R.H.S. Dictionary of gardening*.

In recognition of his many services to horticulture, Cambridge University honoured him with the degree of Master of Arts; the Royal Horticultural Society made him an Associate of Honour in 1936 and two years later he received their highest award, the Victoria Medal of Honour.

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VARIATION IN *ATHYRIUM* IN THE BRITISH ISLES

REGINALD KAYE

Waithman Nurseries, Silverdale, Lancashire

ABSTRACT. About eighty varieties of *Athyrium filix-femina* remain today from a heritage of several hundreds; they are listed and discussed in a classification based on that used by E. J. Lowe in 1890. No extant varieties of *A.distentifolium* or *A.flexile* are known to the author. " Variety " is used in preference to " cultivar ", with which it is synonymous under the International Code of Nomenclature for Cultivated Plants.

Three native species of ladyfern grow in the British Isles:

1 **Athyrium distentifolium,** the Alpine Ladyfern, is locally abundant above one thousand feet in the central Highlands of Scotland up to Sutherland, in shady places by streams and among rocks. It is very similar to 3, differing in having a rudimentary indusium which usually falls off or becomes invisible long before the sporangia are ripe; smaller sori nearer the margin of the lamina; a lighter, more golden-green colour when growing in its native mountain fastnesses. There seems to be no difficulty in cultivating it in lowland habitats. I know no living varieties.

2 **Athyrium flexile.** This rare species is often included within 1, but it differs in having fronds only 9-12 inches long; stipe very short and deflexed; pinnae short, distant, reflexed; pinnules well-separated and deeply cut. It has been reported from high alpine corries in Glen Clova, Ben Lawers and Ben Almond, but has not been seen lately. In 1962 the British Pteridological Society spent some hours in the mountains at the head of Glen Clova and founds lots of *distentifolium*, but no one sighted *flexile*. No varieties are known.

3 **Athyrium filix-femina,** the Ladyfern, is very common and widely distributed throughout the British Isles in damp shady places. The perennial rootstock bears dark-brown scales and becomes branched and woody and covered with old frond-bases. The deciduous fronds are lanceolate, from 12-60 inches long, and usually bipinnate. The pinnae usually end in slender acute points. The pinnules are sometimes so deeply cut that the frond is almost tripinnate. The stipe and rhachis is usually green, darkening towards the base, but is sometimes purplish-red. It is quite difficult to find two plants producing fronds exactly alike.

The innate tendency of British ferns to produce variations is shown to a greater degree in the ladyfern than in any other species, and while there are certain well-defined varieties, these are combined and recombined to such a degree that there seems to be no easy way to classify them. The number of varieties in cultivation today (see list on page 203) which have come down to us from the collections of seventy years ago is difficult to estimate, but

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is probably in the region of 80, though there are no doubt in gardens quite a number existing whose names and origins are unknown to the owners. On the other hand many plants exist which have been raised from spores, intentionally or by chance, which do not quite agree with any of the described varieties, but which may be quite good or even excellent varieties in their own right. There are also very many irregular forms to be seen which are not worth keeping and should be destroyed to make room for more-worthwhile ones.

E. J. Lowe in *British Ferns and where found* (1890) described and classified no less than 313 varieties of ladyfern (including 75 which had received First-Class Certificates from the Royal Horticultural Society or the Royal Botanic Society); in his *Our native Ferns* (1876) he had given 294 (including 58 he had not seen, raised or found by other fern enthusiasts). There is no doubt, however, that in Lowe's day there was a tendency to record and name every slight variation or irregularity with resounding, often hyphenated, latinised polynomials. C. T. Druery in *British Ferns and their Varieties* (1910) described 150 ladyfern varieties which may or may not all have been in cultivation at the time. Very few new varieties have been described since 1910. In 1892 the catalogue of H. B. May & Sons (Upper Edmonton, London) listed 138 ladyfern varieties, while in 1908 W. & J. Birkenhead (Sale, Manchester) offered only 88; these collections have long been dispersed and the nurseries have disappeared. In 1920 W. F. Askew listed 36 varieties of ladyfern in his Borrowdale Nurseries catalogue; this fine collection is now mostly gone. Perry of Enfield had a wonderful collection before the last war, but this was decimated during the war years. When I took over the nurseries of John Stormonth (Kirkbride, Cumberland) in 1937 there were about 20 good varieties of *Athyrium* there. Soon after the war I acquired the entire collection of Robert Whiteside in which there were many ladyferns which he had collected in a lifetime devoted to growing hardy ferns. In my own fern catalogue some 27 varieties of ladyfern are listed, though I have others: many of these are now transferred to reserve beds for propagation.

The only way to propagate many varieties is by division, a slow process. Certain kinds can be reproduced true-to-name from spores, e.g., 'Frizelliae' comes at least 90% true; others are not so reliable and sporelings have to be grown-on for two or three years and rogued before they can be offered as reasonably true-to-name.

Basically, variation is of two kinds: variation in frond-shape due to cresting, and variation in pinnule-shape. Both types can occur together, making classification somewhat difficult; I remember discussing the problem with W. B. Cranfield and he rather deprecated the tendency of British ferns trying to do too many things at once and recommended that some varieties be discarded on this account. It is said, however, that beauty lies in the eye of the beholder and, provided that a variety has beauty and symmetry or interest of some sort, it should at least be recorded and grown by those who wish to cultivate it.

FIGURES 1-9 Varieties of *Athyrium filix-femina*

1 'Caput-Medusae', 2 'Foliosum Grandiceps', 3 'Grandiceps' (dwarf form), 4 'Gemmatum Bolton' (original clone), 5 'Setigerum Corymbiferum Grubb' (original clone), 6 'Acrocladon' (original clone), 7 'Frizelliae' (original clone), 8 'Frizelliae Cristatum' (from spore), 9 'Corymbiferum'.

Lowe (1890) divided 313 varieties of ladyfern into two main divisions, five groups, and fifteen sections. As was done by Dyce for *Polystichum* (GAZETTE 9: 97-109), I have adapted Lowe's classification to analyse the ladyfern situation today.

DIVISION A CHANGE IN FROND SHAPE

Group 1 CRISTATE

(a) **capitate** (*apex crested*)

This section is exemplified by 'Coronatum' which makes a neat plant with a large corymbose crest, but the pinnae are not crested; my plant is more robust than the one described by Moore. 'Capitatum Wollaston' I had from William Askew but lost it.

(b) **cristate** (*apex crested in one plane; pinnae crested*)

Very many forms are to be found of this common type of variation in which the crests are fan-shaped and in one plane, for example 'Cristatum' (Fig. 27). When the divisions of the crests are long and slender and well-separated they are known as polydactylous; a good example today is the very attractive 'Multifidum'.

(c) **percristate** (*apex, pinnae and pinnules crested*)

I have fine large examples of 'Percristatum', and a particularly pretty plumose one mentioned below under B(a).

(d) **corymbose** (*apex crested in several planes to give a bunched cluster; pinnae crested*)

Fine forms, for example 'Corymbiferum' (Fig. 9), are in cultivation, though it is doubtful whether many of the varieties described in Druery still exist. 'Diadematum' has a very large head and many of the pinnae are heavily crested. 'Glomeratum' is a particularly fine example, almost a section in itself, defined by the pinna-crests being corymbose and wider than the pinnae. 'Gemmatum Barnes' with a green stem and 'Gemmatum Bolton' (Fig. 4) with a red stem are perfect examples of glomerate corymbose varieties, both with large almost spherical crests on all pinnae. 'Depauperatum Edelsteinii', which I acquired with the Whiteside collection, might well be included here; apart from the fact that it is not depauperate, it has a peculiarly twisted terminal crest and the whole plant is a particularly vivid green. A corymbose crest, combined with other characters, occurs in other sections.

(e) **grandicipital** (*terminal crest wider than rest of frond; pinnae crested, reduced, or absent*)

In this section are many forms ranging from tall strong-growing varieties with well-developed pinnae to varieties with reduced or depauperate pinnae; 'Nudicaule Cristatum' has no pinnae at all except those involved in the

immense terminal crest, so that the frond is reduced to a ball of verdure on a long stalk. 'Caput-Medusae' (Fig. 1) might be regarded as an extreme grandicipital, or it might equally be included as a ramose under 2(b). The many fine grandicipitals raised by Ellworthy seventy years ago I have not seen since before the Second World War. There are dwarf, otherwise typical, forms of grandicipitals, one of which (Fig. 3) is about 12 inches high; 'Cristulatum Stansfield' is about 9 inches high.

Group 2 OTHER CHANGES IN FROND SHAPE

(a) **cruciate** (*a cross formed by opposite pinnae; each pinna usually reduced to a single pair of enlarged, ± right-angled, opposite pinnules*)

This is a large section and is usually combined with cresting. I do not know whether the morphology of cruciation has been worked out; one theory is that the whole of the pinna, except the pinnules nearest the rhachis, is suppressed, the two remaining pinnules developing to the size of pinnae at an angle to one another, thus forming a cross with the opposite pair of pinnules. A perfect example is 'Fieldii' (Fig. 12) whose long arching fronds show a chain of crosses with no cresting. 'Pritchardii' (Fig. 10) is another charming example on more slender lines, with more than four pinnules involved in each cross so that the pinnae form little tufts. 'Cruciatum Cristatum' differs from 'Fieldii' in being crested, slenderer and about half the length. 'Angustocruciatum Cristatum' (Fig. 11) has very narrow fronds, perfectly cruciate throughout, with a neat flat crest. The crested cruciate par excellence is 'Victoriae' (Fig. 13), a wild find discovered in a country lane in Stirlingshire over a hundred years ago; the original form is still the strongest, making fronds 2-3 feet long of perfect symmetry, narrowly lanceolate, with a good terminal crest and crests to all pinnae; divisions from the original are still with us and show no loss in vigour; how long these divisions of the original clone will continue to maintain their fine constitution remains to be seen; plants raised from spores show the original form but have never equalled its size; some very graceful fine forms have been raised; 'Victoriae Foliosum' (Fig. 14) is in cultivation; 'Setigerum Victoriae' is included under B(c). 'Cruciatum Congestum' is a stiff dark-green dwarf of 6-9 inches, not crested.

(b) **ramose** (*lower part of main axis divided once or more*)

'Acrocladon' (Fig. 6) the finest example of this section, produces a ball of verdure by repeated branching of the rhachis; as it produces spores only occasionally it has to be increased by division, a slow process; when spores have been produced and sown, even more-remarkable forms have been raised, but whether these are still in cultivation I do not know; it was originally a wild find. 'Ramocristatum Sim' does not appear to be about, though unidentified ramocristates are in cultivation. The brachiate varieties, in

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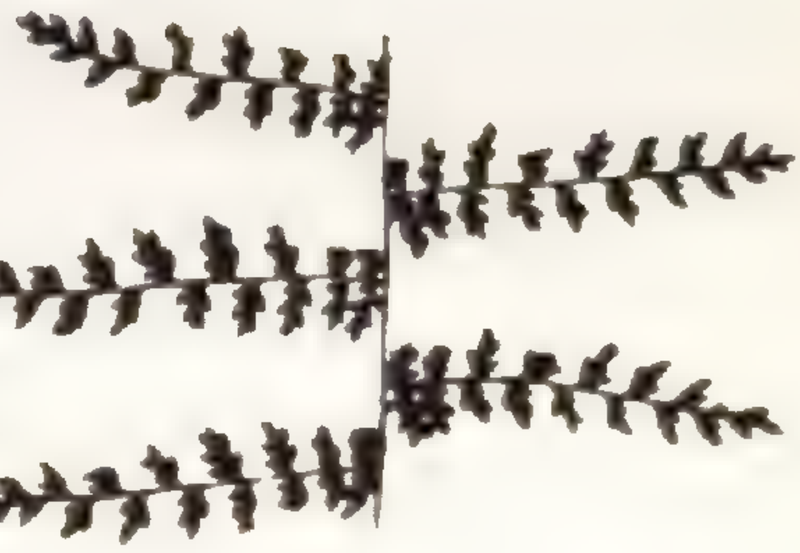

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FIGURES 10–19 Varieties of *Athyrium filix-femina*

10 'Pritchardii' (original clone), 11 'Angustocruciatum Cristatum', 12 'Fieldii' (original clone), 13 'Victoriae' (original clone), 14 'Victoriae Foliosum', 15 'Flabellipinnulum', 16 'Minutissimum', 17 'Congestum Minus', 18 'Crispum Coronans', 19 'Vernoniae' (original clone).

which the rhachis divides into three as though the basal pinnae had developed into fronds (which may be the cause of brachiation) have, I think, been lost.

(c) **congested** (*pinnae close together, often overlapping, usually dwarf*)

Several varieties exist, seldom exceeding 6 inches in height. 'Congestum Minus' (Fig. 17) is extremely congested with pinnae and pinnules all overlapping; it comes true from spores. 'Congestum Grandiceps' is heavily crested and suitable for the rock garden. 'Crispum' is a ramose, crisped and crested dwarf, forming 4-inch-high mats. 'Crispum Coronans' (Fig. 18) is more heavily crested but seldom exceeds 5 inches. 'Minutissimum' (Fig. 16), though not strictly congested, might be included here; it is a perfect miniature ladyfern no more than 2-3 inches high in the open and 5-6 inches in shade, a charming wee fern for the front of the fern border.

(d) **angustate** (*fronds narrow with short pinnae; pinnae twisted, reflexed, or reduced to balls*)

The narrowest ladyfern frond is shown by 'Frizelliae' (Fig. 7), found wild on two occasions in Ireland; it breeds true from spores; the pinnae are reduced to bead-like balls along the rhachis; sometimes called the Tatting Fern, it grows about 12 inches high; sports from the original include several striking crested varieties such as 'Frizelliae Cristatum' (Fig. 8), 'Frizelliae Capitatum', 'Frizelliae Ramocristatum', and some of these attain 18 inches or more; there are ramose dwarf forms; one very dwarf, otherwise normal form of only 3 inches I had from Askew, but it is gone. 'Curtum', found in Lakeland, is a neat dwarfish variety with very short pinnae; the width of the frond seldom exceeds 3 inches, usually less; there is a neat crested form of this, 9-12 inches high. Unequal growth of the upper surface of pinnae can result in twisted and reflexed varieties, such as 'Revolvens'; this is still in cultivation I believe, but to my way of thinking it is more curious than beautiful. The more desirable 'Reflexum Fox' was a neater and more interesting plant, but I fear it may be lost.

DIVISION B CHANGE IN PINNULE SHAPE

(a) **plumose** (*pinnules pinnate or bipinnate; sori scanty or absent*)

This section contains some of the most beautiful ladyferns, their tripinnate and sometimes quadripinnate form giving the fronds an especially feathery and graceful appearance, coupled with a particularly lucent, sometimes golden-green colouring. Several forms have been found in the wild and recorded by their finders, though not many of the originals have persisted to the present day. 'Plumosum Stansfield' (Fig. 20) is one of the many forms found in the wild. The finest forms have been propagated from spores. In a well-grown specimen of 'Plumosum Druery' (Fig. 21) the large quadripinnate fronts are a wonderful sight. I have a similar form, 'Plumosum Penny'

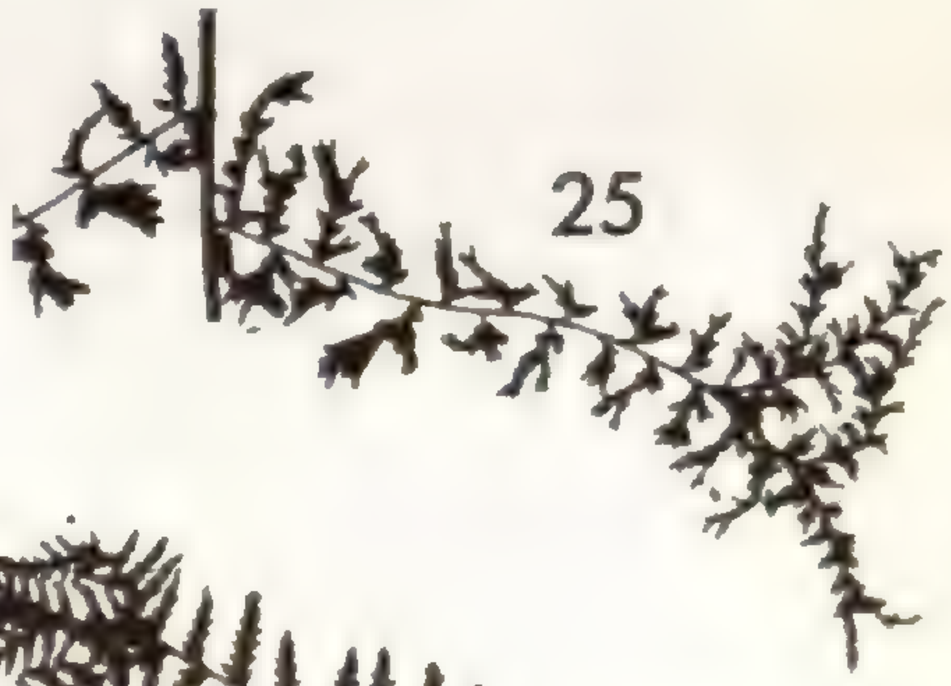
(Fig. 23), raised by Penny of Lancaster. Charles Grubb had some outstanding seedlings which still exist I believe. A further development, the examples of 'Plumosum Superbum' raised by Druery and others, are extra feathery and crested; 'Plumosum Superbum Druery' is still about and is usually prominent at Southport Show. There is a nice percristate plumose in cultivation, very delicate in appearance. 'Plumosum Multifidum' (Fig. 24) is a distinct broad-fronded variety with loosely-crested pinnae on multifid lines. 'Plumosum Furcillans' (Fig. 22) is very dainty and lightly crested, and there are several others which tend to lose their attractive plumose character as they become more heavily crested. The best varieties have to be increased by careful division and, in consequence, are scarce. Perhaps the most remarkable variation in this section is 'Clarissima Jones' (Fig. 26); this has extremely slender attenuated pinnules, and in a good environment can produce fronds 3-4 feet long and 2 feet wide; I had thought it extinct, but recently acquired what I believe to be the true form; as it takes about five years before a double crown is produced, it is not likely to appear in Woolworth's for some time. 'Clarissima Bolton', found in Lancashire, is smaller than Jones's and is even more finely cut; plants of it usually appear at Southport Show, but they are the jealously guarded treasures of one or two growers and pearls would not buy them. 'Clarissima Cristatum Garnett' (Fig. 28), also known as 'Fimbriatum Cristatum Garnett', is a most elegant variety with very wide light-golden-green fronds, chastely crested, and it grows quite tall; I have had fronds over 3 feet long and 2 feet across; it is slow to increase. These forms of 'Clarissima' all show the phenomenon of apospory, but very few youngsters so raised have been worth growing.

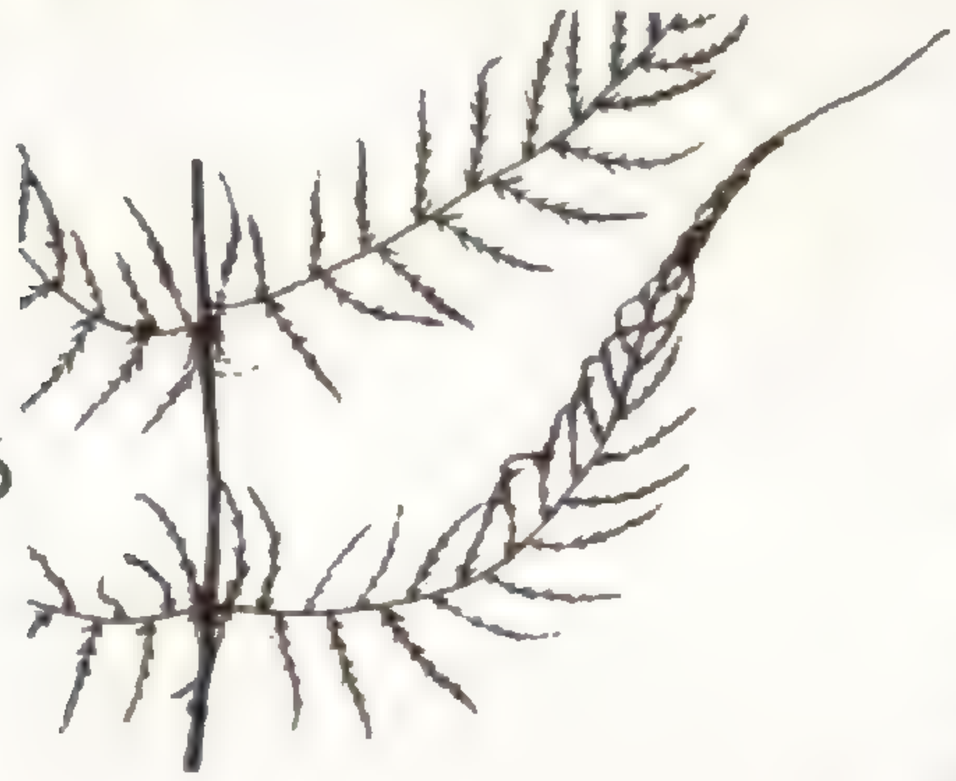
(b) **foliose** (*pinnules wider than normal, almost confluent, often overlapping*)

The pinnules are lushly foliose. The only living example I have seen, 'Foliosum Grandiceps' (Fig. 2), I acquired with Whiteside's collection.

(c) **dissect** (*pinnules finely divided into teeth or bristles*)

This is a large section. 'Setigerum', found in Lakeland by J. Garnett, is very bristly and distinct in appearance and has given rise to a long range of beautiful things such as 'Setigerum Cristatum Garnett' and 'Setigerum Corymbiferum Garnett'; 'Setigerum Corymbiferum Grubb' (Fig. 5) is a superb red-stemmed perfectly symmetrical plant. The feathery 'Pulcherrimum' comes into this section, but is seldom seen. Grubb raised 'Setigerum Victoriae', a perfectly lovely thing; I do not know where it went, and I hope it has a good home somewhere. 'Howardii' (Fig. 25), raised at Levens Hall near Silverdale, is a beautiful lacy crested variety with the pinnules almost as fine as hairs, so that they seldom if ever produce spores; slow to increase, my original plant has worked up to five crowns in the last fifteen years, so in another fifteen years I may be able to list it under 'stock limited'.





FIGURES 20–28 Varieties of *Athyrium filix-femina*

20 'Plumosum Stansfield' (original clone), 21 'Plumosum Druery' (original clone), 22 'Plumosum Furcillans', 23 'Plumosum Penny' (original clone), 24 'Plumosum Multifidum', 25 'Howardii' (original clone), 26 'Clarissima Jones' (original clone), 27 'Cristatum', 28 'Clarissima Cristatum Garnett' (original clone).

(d) **depauperate** (*pinnules reduced, irregular, or missing*)

Many of the depauperate varieties are asymmetrical and not worth garden room. Exceptions are the symmetrical varieties such as 'Mediodeficiens Polydactylum', a very pleasing plant with loose-fingered crests and with the segments much reduced towards the rhachis. Other good forms such as 'Defectofurcillans' and 'Paucidentatum Cristatum Mapplebeck' are extremely rare if indeed they still exist.

(e) **heteromorphic** (*pinnules rounded, narrow, or jagged*)

'Flabellipinnulum' (Fig. 15) is an interesting variety with narrow fronds, slender pinnae and tiny pinnules. 'Vernoniae' (Fig. 19) is very distinct with the pinnae crisped and of broadly triangular outline. I doubt whether any of the varieties with tiny lunulate pinnules (for example 'Pulleri') or narrow pinnules still remain; I would very much like to have them if anyone knows of their existence.

VARIETIES OF *ATHYRIUM FILIX-FEMINA* KNOWN BY THE AUTHOR TO BE IN CULTIVATION TODAY

Angustate: 'Curtum', 'Curtum Cristatum', 'Frizelliae', 'Frizelliae Capitatum', 'Frizelliae Cristatum', 'Frizelliae Multifidum', 'Frizelliae Nanum , 'Frizelliae Ramocristatum', 'Reflexum Fox', 'Revolvens'.

Capitate: 'Capitatum Wollaston', 'Coronatum'.

Congested: 'Congestum', 'Congestum Cristatum', Congestum Grandiceps', 'Congestum Minus', 'Crispum', 'Crispum Coronans', 'Minutissimum'.

Corymbose: 'Corymbiferum' (several forms), 'Depauperatum Edelsteinii', 'Diadematum', 'Gemmatum Barnes', 'Gemmatum Bolton', 'Glomeratum'.

Cristate: 'Cristatum' (and several cristate forms in other sections), 'Multifidum', 'Polydactylum'.

Cruciate: 'Angustocruciatum Cristatum', 'Cruciatum Congestum', 'Cruciatum Cristatum', 'Fieldii', 'Pritchardii', 'Victoriae', 'Victoriae Foliosum', 'Victoriae Gracile'.

Depauperate: 'Defectofurcillans', 'Mediodeficiens Polyactylum', 'Paucidentatum Cristatum Mapplebeck'.

Dissect: 'Denticulatum', 'Howardii', 'Setigerum', 'Setigerum Corymbiferum Garnett', Setigerum Corymbiferum Grubb', 'Setigerum Cristatum Garnett', 'Setigerum Victoriae'.

Foliose: 'Foliosum Grandiceps' (also 'Victoriae Foliosum' above).

Grandicipital: 'Caput-Medusae', 'Cristulatum Stansfield', 'Grandiceps' (several forms), 'Nudicaule Cristatum'.

Heteromorphic: 'Flabellipinnulum', 'Pulleri', 'Vernoniae', 'Vernoniae Cristatum'.

Percristate: 'Percristatum' (several forms, also 'Plumosum Percristatum' below).

Plumose: 'Clarissima Bolton', 'Clarissima Jones', 'Clarissima Cristatum Garnett' (also known as 'Fimbriatum Cristatum Garnett'), 'Congestum Paul', 'Plumosum Druery', 'Plumosum Penny', 'Plumosum Stansfield', 'Plumosum Cristatum', 'Plumosum Furcillans', 'Plumosum Multifidum', 'Plumosum Percristatum', 'Plumosum Superbum Druery', 'Regale'.

Ramose: 'Acrocladon', 'Ramocristatum', 'Uncoglomeratum'.

There must be many more varieties lurking shyly in gardens up and down the country, divisions perhaps from some of those we fear lost, which may have passed through the hands of many owners as properties change hands over the years. It is hoped that anyone possessing unusual forms of ferns will practice good cultivation and propagation to ensure the health and perpetuity of our ferny wealth. In nature, athyriums receive a yearly top-dressing of leaves, which helps to maintain a moist compost around the rhizome. In gardens, the soil-level usually remains the same or falls because of weeding and tidying, and consequently the apex of the rhizome becomes more and more exposed as it grows upwards; for this reason replanting is advisable every three or four years.

I hope these remarks may have thrown some light on the intricacies of variation in the ladyfern and will help in sorting out some of the plants in readers' hands.

I am indebted to Mrs Joyce Parker of the British Museum (Natural History) for preparing the illustrations from plants growing in my nursery.

REVIEW

THE GARDENER'S FERN BOOK by F. Gordon Foster, with drawings and color plates by the author; 226 *pages,* 71 *line-drawings,* 16 *colour photographs,* 18 *black-and-white photographs: Princeton* (*New Jersey*), *New York, Toronto, London: Van Nostrand,* 5 *November* 1964 (*U.S.A. & Canada*), 18 *February* 1965 (*U.K.*); *price* $7.95; 62 *shillings.*

This admirable book by a member of the American Fern Society and of the British Pteridological Society is an introduction to the cultivation of hardy and tender ferns. Written in a most lucid style, primarily for American readers, it contains a wealth of interest for British gardeners. It is divided into nine chapters which encourage the reader to take up an interest in ferns by describing their structure, reproductive processes, methods of identification and recording, and giving directions for propagation and cultivation in the garden and home. These chapters are followed by two sections, one on 40 hardy ferns for the garden and one on 27 tender ferns for indoors. Each fern receives a page of description and cultural instructions; on the opposite page are excellent line-drawings of close-ups of diagnostic details such as pinnae showing venation and sori, as well as silhouettes of complete fronds; the scale of these drawings is readily understandable from sizes given in the accompanying text. In addition, the book is very well illustrated with photographs in colour and black-and-white; to my mind some of the red backgrounds of the colour pictures are unpleasing. Detailed charts tabulate all the information on the ferns dealt with in the previous sections, so that it is very easy to look up descriptions and requirements. A good glossary, a list of nine commercial sources of supply in U.S.A., and a comprehensive index complete this very well-presented book.

Waithman Nurseries, Silverdale REGINALD KAYE

BRITISH FERNS IN A WORLD PERSPECTIVE

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Thirty years ago Carl Christensen, in the introduction to the third supplement to his *Index Filicum*, estimated that almost 10,000 species of ferns were then known. A good many new species have been described since 1934, and most new collections from the wet tropics produce more. One may thus regard 10,000 species as a conservative estimate of the world fern flora. The number of species in Britain is about 0.5% of the whole. My present object is to try to show how this small fraction is related to the great mass of tropical ferns.

The great majority of the world's ferns have sporangia which are basically similar in structure, though differing in details; they are usually called leptosporangiate ferns (*leptos* means thin, delicate). The remaining ferns belong to a few rather small and very diverse groups: Ophioglossaceae (the Adder's Tongue and the Moonwort in Britain have relatives throughout the world, but they are nowhere abundant); Marattiaceae (a family of ferns found only in the wet tropics, many growing to a very large size, probably related to ancient fossils); and the heterosporous ferns (only *Pilularia* native in Britain) which belong to three distinct families the relationship of which to other groups of ferns is still obscure. The remainder of this discussion deals only with the leptosporangiate ferns.

The "primitive" leptosporangiate ferns

The distinctive feature of the sporangium of leptosporangiate ferns is the annulus, a more or less continuous ring of cells with walls thickened in such a way that on drying stress develops in the ring, which ultimately breaks and so scatters the spores. The more highly evolved ferns have smaller sporangia and a more perfect mechanism for this breaking of the annulus than the more primitive ones. The fact that the latter are primitive is demonstrated by their occurrence in fossils. Botanists first began to examine the annulus critically just before the year 1800, and soon recognised the families which are usually called primitive because of the primitive structure of their sporangia; many of these ferns are highly specialized in other ways.

OSMUNDACEAE. The British representative is the Royal Fern *Osmunda regalis*. There are a few other *Osmunda* species throughout north temperate regions and in the wet tropics; also in south temperate regions the allied genera *Todea* and *Leptopteris*. The family has a more clearly defined fossil history than most others. The sporangia are large, almost spherical, with a clear line of dehiscence but no distinct annulus. They are however very like those of the genus *Mohria* (Schizaeaceae) and one can see the relationship between the sporangia of *Mohria* and of other members of its family which have adistinct annulus.

SCHIZAEACEAE. This family is not represented in Britain today, but there are fossils of the genera *Anemia* and *Lygodium* in the London Clay; these genera occur today in N. America and probably disappeared from Europe in the glacial period. The other living genera are *Schizaea* and *Mohria*. The four genera are very diverse and all specialized; the most ancient ferns known with similar sporangia (found in Carboniferous rocks in Britain) had large fronds rather like those of tree-ferns of today. It seems probable that the existing British genera *Cryptogramma* and *Adiantum* are derived from the same stock as the genera now placed in Schizaeaceae, but these two genera have sporangia of a " modern " type.

GLEICHENIACEAE. Ferns of this family are the commonest thicket-forming sun-ferns in the wet tropics today; they have increased greatly in recent years owing to the felling of forests by man. The family is represented by fossils in the Eocene of Britain and by numerous others in north temperate regions (and Greenland) but its extra-tropical distribution today is only in the southern hemisphere. Most modern members of the family have repeatedly forked fronds; the forking has been regarded as a primitive character, but it is due to dormancy of apices in very precise patterns, and in my opinion there is nothing primitive about it. It is possible that *Polypodium* and allied genera of today have a common ancestry with this family, but this is still very uncertain.

HYMENOPHYLLACEAE. Filmy-ferns (three British species) are extremely abundant in the wet tropics, especially on trees in mountain forest in the cloud zone, where the ferns may be dripping wet a great part of the time. The number of species now known is about 600. Copeland has divided them into 34 genera, mostly on minor characters, and in my opinion the number should be considerably reduced. Such a reduction however is not a simple problem. Further chromosome studies (at present very incomplete) may help. The largest tropical species of *Trichomanes* have fronds two feet or more long; these mostly grow on rocks by streams in deep shade.

CYATHEACEAE. This is the family of the tree-ferns. In recent years it has been customary to divide it into two families, which the late F. O. Bower thought to be very divergent; but it seems to me that they are so closely related that it is natural to unite them (see *Flora Malesiana*, Ser. II, vol. 1). The genera with a more primitive type of sorus, at the end of a vein and protected both by a reflexed small lobe of the leaf and by an inner indusium, are *Dicksonia*, *Cibotium* and *Culcita*; they have a more restricted distribution today than in the past, and they also share the primitive character of a hairy protective covering of their growing parts. The rest of the family consists of the great genus *Cyathea*, certainly of more than 500 species, throughout the wet tropics and in south temperate regions. The young parts of *Cyathea* plants are protected by scales (hairs are also present); the sori are on the lower surface of leaflets, not at the ends of veins, and in most cases have indusia. The German morphologist K. von Goebel suggested

that a simple change in marginal growth would change a *Dicksonia* sorus into one like *Cyathea*, and this seems to me a very reasonable suggestion.

Other characters besides the sori which are important are the structure of the rhachis and the way in which the bases of leaflets are adjusted to it, the distribution of hairs (especially on the upper surface of branches) and the shape of the frond (whether broadest at base or narrowed downwards). In all these characters one can see close similarities to various members of the great mass of " modern " terrestrial ferns which are now commonly included in the genera *Dryopteris*, *Thelypteris*, *Athyrium* and their respective allies (see below). It seems to me also that the indusia of these genera could all have been evolved from the various types of indusia known in Cyatheaceae. I suggest therefore that these great groups of " modern " ferns are derived from the same stock as Cyatheaceae, though there are considerable differences in anatomy, scales, sporangia, spores and chromosome numbers which indicate that the " modern " ferns could not be included in a family Cyatheaceae.

The " modern " leptosporangiate ferns

Until very recently it has been the custom to include almost all ferns other than the families mentioned above in a comprehensive family Polypodiaceae, which included some 80% of the world's ferns. But it has become increasingly evident that such a " family " included a number of more or less distinct sub-groups, each of which must have had an independent evolution; and sporangia indicate that they all came originally from the same stock as the " primitive " families. The only rational solution seems to be to try to distinguish these different evolutionary lines, and to call each of them a family. There will inevitably be some difficult and doubtful cases, but I think the general scheme is now becoming fairly evident. However, no two pteridologists agree on details, and I prefer at present to arrange the genera in " groups," rather than give these groups definite family names.

BRACKEN (*Pteridium aquilinum*) belongs to a not very clearly defined group of genera which all have a hairy creeping rhizome and so are more or less capable of forming thickets. This group is rather on the border-line between " primitive " and " modern " as regards form of sporangia and sori. The genus *Pteridium*, which is world-wide, is specialized in its sori which spread from one vein-end to the next, and in the complex anatomy and branching of its rhizome. The important tropical genera are *Dennstaedtia*, *Hypolepis* and *Microlepia*; I think these still need to be more clearly defined. There is an awkward genus which has sori much like those of *Dennstaedtia* but an erect scaly stock (*Orthiopteris*). The whole group presents many problems. Chromosome study might help, but not enough species have yet been investigated. In the new *Flora Europaea* the Bracken family is called Hypolepidaceae; Copeland includes it in his too-comprehensive family Pteridaceae. (For a note on *Pteris*, see the *Adiantum* group.)

THE THELYPTERIS GROUP. This is represented in Britain by three species, now usually known as *Thelypteris palustris* (type of the genus), *T. limbosperma* and *T. phegopteris*. The whole group includes about 900 species throughout the world. C. V. Morton is so impressed by the common characters within the group that he would include all in one genus *Thelypteris* (Amer. Fern Journ. **53**: 149, 1963). R. C. Ching, on the other hand, proposes 17 genera for the species in Asia (Acta Phytotax. Sinica **8**, no. 4, 1963). Certainly sub-groups can be recognized, but not all have yet been clearly characterized. Of our British species, *T. phegopteris*, belongs to a small but very distinct sub-group which would be called *Phegopteris* if given the rank of a genus. But there is a closely allied sub-group which Ching calls *Pseudophegopteris*, and it is not yet clear to me whether these should be united. It appears that our other two British species have tropical allies (especially in mountain forest) but they have not yet been sorted out. The details of the scales on young fronds give the best means of recognition of genera, and they need to be examined with a microscope; very many have not yet been so examined. Chromosome-number offers useful guidance, but cytological investigations are still very incomplete. There is a range of basic numbers from 30 to 36, contrasting with 40-41 in the *Dryopteris* group. It seems to me likely that our British species should rank as members of three genera, which would be called *Thelypteris*, *Lastrea* and *Phegopteris*. In distribution of hairs, and in some characters of scales, the *Thelypteris* group shows resemblances to *Cyathea* which seem to me significant; these need to be more fully investigated.

THE DRYOPTERIS GROUP. Besides *Dryopteris* (8 species in Britain), I would include here *Polystichum* (3 species in Britain), *Gymnocarpium* and *Woodsia*. These agree in scale-characters, rhachis-structure and chromosome-number (40 or 41), in all of which they differ from the Thelypteroid ferns (*Gymnocarpium* is sometimes included in Thelypteridaceae, but I see no reason for this). *Dryopteris* is a very large and world-wide genus, reaching its maximum in the region from the Himalayas to West China, where its distinction from *Polystichum* possibly breaks down. The solution of recognizing a third genus (wrongly called *Rumohra* by Ching and *Polystichopsis* by myself, correctly *Arachniodes*) seems to me not yet clearly established. *Gymnocarpium* is a very distinct genus of few species in north temperate regions (extending to the Philippines and New Guinea); it was formerly included in *Polypodium* because of the absence of an indusium, but in other characters is very unlike *Polypodium*. In many genera of ferns (including *Cyathea*) some species have lost indusia, and one can find indusiate and exindusiate species which in other respects are extremely alike, so that the absence of an indusium by itself is not a very important character in classification. *Woodsia* is a more isolated genus, of about 38 species, on mountains in the northern hemisphere and in South America. Its cup-

shaped indusium is at first sight very different from the kidney-shaped indusium of *Dryopteris*, but within the genus *Cyathea* differences as great can be found; I think that both the *Dryopteris* and the *Woodsia* form of indusium derive from a common origin. Among the genera of Cyatheaceae, members of the *Dryopteris* group are nearest to *Culcita*, matching *Culcita* exactly in rhachis form, and usually in the triangular shape of the fronds.

The North temperate Ostrich Fern (*Matteuccia struthiopteris*, hardy in Britain) is *Dryopteris*-like in scales and indusia, but has very reduced fertile pinnae, superficially like those of some species of *Blechnum*. The genus *Onoclea* (now north American, known as a fossil in Britain, often cultivated) is usually associated with *Matteuccia*, but has important differences, including chromosome-number, and its place seems uncertain.

THE ELAPHOGLOSSUM GROUP. This comprises several genera which appear to be related, and together to form a distinct offshoot from the same stock as *Dryopteris*. They have reduced fertile fronds which are covered with sporangia on the lower surface, and their rhizomes are dorsi-ventral in structure, adapted for creeping on rocks or climbing trees (roots only grow from the often widened lower surface). They are all tropical or subtropical. The most aberrant genus is *Elaphoglossum*, almost all species of which are epiphytes with simple fronds (one species in Madeira; the majority in South America but a few through Africa and Asia). The climbing genera are exceedingly interesting, and one of them (*Teratophyllum*) has been much confused because young plants bear peculiar fronds which have not always been correctly associated with fronds of mature plants.

THE TECTARIA GROUP. This is entirely tropical and subtropical. It has sori much like *Dryopteris* but a different rhachis-structure and peculiar multicellular hairs on the upper surface of the rhachis.

THE ATHYRIUM GROUP. In Britain we have three species of *Athyrium*; with these I would associate the genus *Cystopteris*. Alston and others have recognized a family Athyriaceae which includes these genera and *Woodsia*. I cannot see why such a family should not be united to *Dryopteris*; if it were, it would be called Aspidiaceae. The whole question seems to me to be still open. But I would not agree to the suggestion of Ching and Copeland that *Athyrium* is nearly related to *Thelypteris*.

Athyrium is a world-wide genus of nearly 200 species; but Copeland has added to it the genus *Diplazium* of at least 400 species, stating that no clear line can be drawn between them. To draw such a line one needs to eliminate some peculiar groups of species as separate genera, and this has not yet been satisfactorily accomplished. It is a very complex, worldwide, problem. The tropical species of *Diplazium* are among the commonest terrestrial forest ferns. The sori of some of them are very like *Asplenium*, for which reason they were formerly included in *Asplenium*. But in anatomy, rhachis-form

and scales they are very different from *Asplenium*, and I believe that the two genera have evolved their similar sori from different origins. The genus *Athyrium* (*sens. str.*) shows how the elongate sori of this group have evolved from the kidney-shape of *Dryopteris*; all stages can be seen on one pinna of *A. filix-femina.*

Cystopteris is a genus of 10 species. Two of these have been separated as a genus *Acystopteris*, but this ranks as a subgenus in the latest monograph. Most species grow in rock-crevices, like our native *C. fragilis*, which itself is worldwide apart from the wet tropics.

THE ASPLENIUM GROUP. *Asplenium* (seven British species) is a worldwide genus of 700 species, most of them epiphytes or rock-plants. Copeland includes *Phyllitis* in *Asplenium*, and I would agree. It is evident that the primitive condition in *Asplenium* is a large much-branched frond (the largest tropical ones may be six feet long). From this condition, various evolutionary lines have led to simple fronds, and in species on at least three of these lines there are pairs of sori facing each other as in *Phyllitis scolopendrium.* It is clear that a definition based on this single character would give a quite unnatural genus. It is also clear that *Phyllitis scolopendrium* is closely related to some of our native species of *Asplenium*, as demonstrated by the occurrence of hybrids. The genus *Ceterach* is more distant, but still near enough to *Asplenium* to permit of intergeneric hybrids; it is a genus of few species of north temperate regions. The position of *Asplenium* in relation to other groups of genera seems to me still uncertain. It is perhaps nearest to *Blechnum*, but not very near.

THE BLECHNUM GROUP. *Blechnum* (including *Lomaria*) is a genus of about 200 species mainly occurring in the southern hemisphere; our British species, *B. spicant*, is the only one in Europe. In New Zealand, *Blechnum* has more species than any other fern-genus. The related genus *Woodwardia*, which has more amply branched fronds, some very large, occurs only in the warmer parts of the northern hemisphere (northwards to Madeira). The genus *Doodia*, like *Blechnum*, is mainly southern; the plants are all rather small, with stiff fronds. As with *Asplenium*, the relationship of *Blechnum* to other groups of ferns is in my view uncertain; *Matteuccia* has been suggested as a link connecting with the *Dryopteris* group.

THE DAVALLIA GROUP. This comprises a few closely allied genera of epiphytes with long-creeping stems and in most cases finely divided fronds. Many species are very beautiful, and some are well-known as greenhouse or house plants. *Davallia* has strong resemblances to *Polypodium* in rhizome-anatomy, scales and spores, but in sori and venation is extremely different; the relationship of the group seems to me uncertain. The genus *Nephrolepis* is often closely associated with *Davallia* but shows many differences.

THE ADIANTUM GROUP. In Britain we have the genera *Adiantum*, *Cryptogramma* and *Anogramma*, one species of each. There is no true indusium (though the edge of the frond is sometimes reflexed, protecting the young sporangia) and the sporangia run along the veins. These three genera represent a very large and diverse group of genera which mostly occur in the drier and warmer parts of the world; few occur in the wet tropics. Opinions differ as to the delimitation of families within the group, and more study is needed. The genus *Adiantum* includes more than 200 species, most numerous in South America, whence many have been brought into cultivation as greenhouse plants. The genus *Pellaea* (80 species) is also most abundant in South America and includes some very elegant species easy to grow under glass. *Cryptogramma* is credited with only three species, all north temperate, but it is very closely allied to some other genera. *Anogramma* is a small genus of world-wide distribution. It seems probable that all the genera in the group are allied to Schizaeaceae.

The genus *Pteris*, worldwide and complex, is often included in this group of genera, though formerly associated with *Pteridium*. It still seems to me possible that it is allied to *Pteridium* rather than to the group of *Adiantum* and *Cryptogramma*.

THE POLYPODIUM GROUP, or Polypodiaceae in the strict sense. This is a large and very natural family, almost all members of which are epiphytes (as our British species often is). Until recently all members of the family which have round sori (a majority) were included in a very large genus *Polypodium* (which was also made to include the genus *Grammitis* and its allies, now regarded as constituting a distinct though probably allied family). The present tendency is to recognize a number of distinct genera, but their precise limits are not agreed; in particular it is not yet clear what should be the limits of a restricted genus *Polypodium* (I am doubtful whether the treatment in my book on Malayan ferns is a good one). Almost all members of the family have veins in an elaborate network, with free veinlets in each mesh of the net; *Polypodium vulgare* with its free veins thus looks like an outlying member of a great net-veined tropical alliance. A similar netted venation, and similar sori, occur in the genus *Dipteris* (a few species, from the N.E. Himalayas to New Caledonia, mostly on mountains), and *Dipteris* is similar in many ways to extinct ferns known as fossils from Jurassic rocks (some in Britain). It has therefore been suggested that *Dipteris* represents the ancestral stock from which modern Polypodiaceae have evolved. But *Dipteris* has many differences from Polypodiaceae (in cytology, anatomy, scales and sporangia) so that it is probably better in a family of its own.

Specialization has occurred in the family Polypodiaceae in various different ways. Some species have very thin fronds and are adapted to life in shady forest near streams (some on wet rocks rather than trees), others are very tough and grow on exposed tree-branches; in some species of both thin

and tough types, sori have spread along the veins and joined to form lines, or in some cases have covered the lower surface of fertile fronds completely, sterile fronds being much broader. Species with sori running along the veins were formerly called *Gymnogramma* and associated with entirely different ferns which had acquired this character on separate evolutionary lines. Similarly, the Polypodiaceae which have fertile fronds covered beneath with sporangia were associated with the quite unrelated mangrove fern, *Acrostichum*. A peculiar form of specialization is in relation to ants. Ferns of the genus *Lecanopteris* have a fleshy rhizome, parts of which internally are soft. The soft parts are eaten away by ants, which make their nests in the cavities. The ants also bring small seeds, some of which germinate in the crevices between branches of the *Lecanopteris* rhizome, and so a mass of epiphytes (often of large size) starts on the branch of a tree. The most extreme specialization is found in the genus *Platycerium*, which has two kinds of fronds, one growing upwards, collecting dead tree-leaves which rot and form a compost for the fern's roots, the other kind growing outwards or downwards and bearing the sporangia, which are in large fertile areas and are protected when young by interlacing stellate hairs. There is another very distinct group of species, now placed in several genera allied to *Drynaria*, which have two kinds of fronds serving similar purposes to those of *Platycerium* but in a simpler way.

From the above very sketchy and incomplete survey, I hope it will at least be evident that British ferns can only be understood when seen in relation to the ferns of the whole world; further, that the world's ferns need much more study before we can have a satisfactory conspectus of them, and that the whole problem is one of considerable complexity.

REVIEW

COLOURED ILLUSTRATIONS OF THE JAPANESE PTERIDOPHYTA by Motozi Tagawa; (IV) +270 pages, 72 plates; Osaka: Hoikusha, 1959, and subsequently reprinted; price about £3.

In this attractive and handy work the entire fern flora of Japan is illustrated. Although the main text is in Japanese, Latin names are given and each of the figures (1-399) is numbered so that it is easily identified or looked up in the *INDEX PTERIDOPHYTARUM JAPONICARUM* which occupies pages 173-262. The latter is a complete enumeration of Japanese ferns under their Latin names, giving references and synonymy for each recognized species, with all synonyms cross-indexed. Inevitably there will be some disagreements over nomenclature, for example in the use of *Lastrea* instead of *Thelypteris*. The figures were prepared from colour-transparencies and are good, even though there is some loss of detail. For those interested in Japanese ferns but not acquainted with the Japanese language, the *INDEX* and the illustrations alone make this book most valuable. The price, though high, is not excessive and the standard of production is excellent.

Royal Botanic Gardens, Kew FRANCES M. JARRETT

TAXONOMIC NOTES ON JAMAICAN FERNS

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ABSTRACT. New combinations are proposed in *Arachniodes*, *Blechnum*, *Grammitis*, *Pityrogramma* and *Stigmatopteris*. In addition are the following 4 new species: *Blechnum antillanum* (p. 00), *Ctenitis harrisii* (p. 00), *C. parvula* (p. 00), and *Pityrogramma williamsii* (p. 00). *Asplenium sciadophilum* (p. 00) is a new name for a species with a confused nomenclatorial history. *Polypodium microchasmum* is transferred to the synonymy of *P. leucosticton*, and a few other ferns are also discussed.

There seems to be no end to the problems confronting anyone who attempts to deal comprehensively with the ferns of Jamaica. The present writer has now spent more than 15 years trying to learn enough concerning these plants to publish a book about them, and while it must be admitted that other activities have taken up a good deal of time, one might suppose the end to be in sight. Actually, there is a considerable manuscript well in progress, but numerous problems continue to delay completion. The present paper makes a few necessary name-changes, and publishes several undescribed species. The principal remaining problems (not dealt with here) lie in the genera *Diplazium*, *Hypolepis*, and *Polypodium*, and also in some general questions of family and generic status. It is hoped that these can be resolved in the near future.

The writer is indebted to William T. Stearn of the British Museum (Natural History) for latinizing the descriptions of new species. Also acknowledged with gratitude is the opportunity to have worked for a time at the British Museum (Natural History) and at Kew, where so many types of Jamaican ferns are kept.

Unless otherwise noted by the appropriate symbols, cited specimens are in the herbarium of the Institute of Jamaica (IJ).

ARACHNIODES Blume, Enum. Pl. Jav. 241-242 (1828)—*Byrsopteris* Morton in Amer. Fern Journ. **50**: 149 (1960).

The separation of this taxon from the related genera *Dryopteris* and *Polystichum* has been thoroughly discussed by Tindale (Contr.N.S.Wales Nat.Herb. **3**: 89-90, 1961; op. cit. Flora Ser. nos 208-211: 55-59, 1961). It is unfortunate that Morton, when previously discussing the same group, overlooked Blume's earlier name. This necessitates new combinations again for the two Jamaican species of the genus.

ARACHNIODES **denticulata** (Swartz) Proctor, **comb. nov.**, based on *Polypodium denticulatum* Swartz, Prodr. 134 (1788). This species has also been placed in *Aspidium*, *Polystichum*, *Nephrodium*, *Lastrea*, *Dryopteris*, *Rumohra*, and *Byrsopteris* by various authors. TYPE from Jamaica, *Swartz*.

ARACHNIODES **rigidissima** (Hook.) Proctor, **comb. nov.**, based on *Nephrodium denticulatum* var. *rigidissimum* Hook., Sp. Fil. **4**: 148 (1862); *Dryopteris rigidissima* (Hook.) C.Chr. in Dan. Vid. Selsk. Skr. VIII, **6**: 118, f.27 (1920); *Byrsopteris rigidissima* (Hook.) Morton in Amer. Fern Journ. **50**: 152 (1960). TYPE from Jamaica; Hooker cited "*Purdie*, *Wilson* (who observes, 'I mistook this at first for the leaf of a carrot')", but Morton (under *Byrsopteris*) has cited only the Wilson collection (K), thus apparently choosing this as lectotype.

ASPLENIUM **sciadophilum** Proctor, **nom. nov.** "*Caenopteris rhizophylla* Smith" sensu Hook. & Grev., Ic. Fil. **2**: t.193 (1831), non Smith, Pl. Ic. Ined. **2**: t.50

(1790); non *Asplenium rhizophyllum* L. (1753), nec Kunze (1834). *Asplenium myriophyllum* Spreng. (var.) *β macraei* Griseb., Fl. Br. W. I. 684 (1864), pro parte, non *Asplenium macraei* Hook. & Grev. (1831). *Asplenium lunulatum* "var. *A. strictum*" Jenman, Ferns Br. W. I. & Guiana 162 (1909), non *Asplenium strictum* Brack. in Wilkes (1854). TYPE from Jamaica: Hook .& Grev., Ic. Fil. **2**: t.193.

J. E. Smith's *Caenopteris rhizophylla* was based on a specimen allegedly from Dominica collected by Thierry, which Smith received from Thouin; this appears to represent the species now called *Asplenium conquisitum* Underw. & Maxon. Hooker and Greville wrongly identified material from Jamaica as being the same, and published an excellent illustration under the name *Caenopteris rhizophylla*. However, their plant is neither the same as Smith's, nor is it anything like the Linnaean *Asplenium rhizophyllum;* both of those species bear fronds with proliferous flagelliform apices; the former also differs in the details of cutting, while the latter has simple, entire blades. The non-proliferous Jamaican species illustrated by Hooker and Greville seems therefore to lack a valid epithet, and I am herewith proposing for it the name *Asplenium sciadophilum*.

Few ferns have been the subject of more confusion than this species and its relatives, due partly to the broad and imprecise species-concept imposed on pteridology by the authority of W. J. Hooker and his associates during the second half of the nineteenth century. *Asplenium sciadophilum* is related to the plant tentatively called *A. sessilifolium* Desv. by Christensen (K.Svensk. Vet.Akad.Handl.III, 16;51, 1936) as occurring in Haiti, and also to the much larger *A. ocoense* C.Chr. of the Dominican Republic. From *A. sessilifolium* it differs in that the secondary divisions (pinnules) are all (except the basal acroscopic ones) simple, oblanceate, and usually more or less falcate, each with a single unbranched (rarely once-forked) midvein and a solitary sorus. From *A. ocoense* it differs not only in the much slenderer (1 mm v. 2 mm) and shorter (2–6 cm v. c.15 cm) stipes, but also the blades are narrower (2.5–4 cm v. 7–9 cm) with fewer pinnae (25–30 v. 30–35), and the texture of the tissue is thinner and more delicate. Further, the rhizome-scales are narrower and more attenuate. It does not appear to be very closely allied to the *A. myriophyllum* group, with which it has sometimes been confused in the past. Hooker and Greville's plate (the type) is an excellent representation and can be exactly matched by numerous Jamaican specimens, among which can be cited *Clute* 135 (PH), *Harris* 7166 (JAM), *J.P.*135 (JAM), *Proctor* 4230, 5324, 24640 (IJ, etc.), and *York* 100 (UP). Other, mostly unlocalized specimens occur in many herbaria.

Maxon annotated various herbarium specimens with the unpublished epithet *scopulinum*. I have not seen Maxon's own material or his notes, and have chosen to use a different epithet because Maxon's does not seem quite appropriate; this species does not grow strictly "on rocks" but chiefly on crumbling shaly ledges or earth banks, always in dense shade.

Although *A. sciadophilum* is here assumed to be endemic to Jamaica, some very similar (if not conspecific) forms occur in South America. Among specimens seen, *H. H. Smith* 2206 (NY, PH) from Santa Marta, Colombia, seems especially close. Further study is required to establish the relationship of these plants.

✓**Blechnum antillanum Proctor, sp. nov.**

Rhizoma breviter repens vel ascendens, apice paleis nitide brunneis deltato-attenuatis squamatum. *Frondes* ascendentes, plerumque 15-30 cm longae, fere dimorphae; *stipites* basin versus sparsim squamati, ei frondium fertilium

laminas aequantes vel excedentes. *Laminae* oblongo-ovatae ad late ovatae, 8-15 cm latae, basi perfecte pinnatae, sursum pinnatisectae; segmenta supera basi adnata parum dilatata, apice ad pinnam magnam integram vel basaliter auriculata abrupte redacta; *pinnae* 3-8-jugae, lanceato-lineares vel lanceato-oblongae, falcatae, 10-15 (-18) mm latae (prope medium latissimae); paria infima 1-2 saepe leviter deflexa paria proxima supera aequantia vel eis paulum breviora; *venae* simplices vel 1-2-furcati. *Sori* continui vel interrupti, ei divisionum superorum plerumque basi secus rhachim decurvi; *indusium* minute ciliolatum.

Rhizome short-creeping to ascending, scaly at apex (the scales glossy brown, deltate-attenuate), weakly stoloniferous. *Fronds* ascending, mostly 15–30 cm long, subdimorphic; *stipes* sparsely scaly towards base, those of the fertile fronds as long as or exceeding the blades. *Blades* oblong-ovate to broadly ovate, 8–15 cm broad, fully pinnate at base, pinnatisect upwardly, the upper segments being adnate and slightly dilated at base, abruptly reduced at apex to a large entire or basally auriculate terminal pinna; *pinnae* 3–8 pairs, lance-linear or lance-oblong, falcate, 10–15 (–18) mm broad (widest near middle), the lowest 1–2 pairs equal to or slightly shorter than the next upper ones and often slightly deflexed; *veins* simple or 1- or 2-forked. *Sori* continuous or interrupted, those of upper divisions usually decurved at base along the rhachis; *indusium* minutely ciliolate.

TYPE from Jamaica, Parish of **St. Mary**: near the Ugly River Bridge, *J.P.*282 (JAM, isotype US). PARATYPES: from the same locality, *Maxon* 800 (US), *Proctor* 21398 (IJ); **St. Andrew**: Brandon Hill, *Harris* 7422 (JAM); **St. Thomas**: deep ravine above House Hill, *Maxon* 8865 (GH, NY, US). Dominican Republic: Arroyo Loma Bajita, *Valeur* 891 (IJ, ex US). What is apparently the same species has also been recorded from the Lesser Antilles (Guadeloupe & St. Vincent), and a very similar form occurs in Central America (cf. British Honduras: *Gentle* 5071; and Honduras: *Standley* 22626). The species therefore probably has a wider distribution than here indicated, but at the present time material is not available.

This entity was called *Blechnum longifolium* by Jenman and his contemporaries, and *B. fraxineum* "sens. lat." by several later writers, but differs from both those species (which do not occur in the West Indies) in numerous details. From the common *B. occidentale* it can be distinguished by the fronds having fewer, relatively larger pinnae, terminated abruptly in a large terminal pinna, by the longer stipes (especially of fertile fronds), and by the sori of the upper pinnae being conspicuously decurved at the base. Material from the type locality is now under cytological study in England, but information from this source is not yet available.

It is possible that a validly published name already exists for this species, if it occurs in South America. As L. M. Underwood said long ago in a letter to William Harris, "There is a perfect jungle of *Blechnum* species in the *occidentale-longifolium-unilaterale* group". These have never been properly elucidated. I have named the Jamaican plant "*antillanum*" to emphasize that the species being described is based strictly on West Indian material. Its precise position must await a definitive monograph of the group.

BLECHNUM PLUMIERI var. **nigrocarinatum** Proctor, **nom. et stat. nov.** *Osmunda polypodioides* Swartz, Prodr. 127 (1788); *Blechnum polypodioides* (Swartz) Kuhn, Fil. Afr. 92 (1868), non Raddi (1819); *Struthiopteris polypodioides* (Swartz) Trev. in Atti Ist. Ven. III, **14**: 571 (1869). TYPE from Jamaica, *Swartz*.

In the study by Broadhurst (Bull. Torrey Bot. Club **39**: 270–275, 1912) of West Indian *Struthiopteris*, *S. plumieri* and *S. polypodioides* were maintained

as separate species. However, they are obviously very closely related, and an examination of numerous collections shows that there is an intergradation in the Lesser Antilles area. This suggests that they are better treated as varieties of a single polymorphic species (now placed in the genus *Blechnum*). In considering possible epithets to use for the variety occurring in Jamaica, it is evident that the name *polypodioides* is available at the varietal level, but the writer feels that it would be confusing to use varietally a name now also applied to a different species of the same genus. Therefore a new name is here proposed, based on the type of Swartz's *Osmunda polypodioides;* this name would also be available at the species level for the same plant.

BLECHNUM POLYPODIOIDES Raddi in Opusc. Sci. Bol. **3**: 294 (1819) (non Kuhn, 1868); TYPE from Brazil, *Raddi* (not seen), illustrated in Raddi, Pl. Bras. t.60, f.2 (1825). *Asplenium blechnoides* Lagasca ex Swartz, Syn. Fil. 76 (1806); *Blechnum unilaterale* Swartz in Ges. Naturf. Freund. Berlin Mag. **4**: 79, t.3, f.1 (1810), illegitimate because superfluous when published; *B. blechnoides* (Lag. ex Swartz) C.Chr., Ind. Fil. 151 (1905), non Keys. (1873).

Under the present International Code of Botanical Nomenclature, it seems necessary to take up Raddi's name for this common and widespread species. In any case, the name cannot continue to be used for the following entity, which requires a new epithet if recognized as a species.

✓CTENITIS **harrisii Proctor, sp. nov.**

Rhizoma decumbens, 7-10 mm crassum, apice paleis fuscis flavo-brunneis lineari-attenuatis ad 1.5 cm longis 0.4–1 mm latis eglandulatis integris dense vestitum. *Frondes* plures fasciculatae usque ad 30 cm longae; *stipites* laminis breviores vel eas aequantes, 6–15 cm longi, intense rubro-brunnei, plerumque eglandulati, paleas numerosas patentes atrobrunneas filiformes ad 8 mm longas basi paulum tumidas e cellulis densis elongatis vix clathratis formatas ferentes. *Laminae* tripinnatae ambitu lanceolatae vel lanceato-oblongae, 10–17 cm longae, infra medium 6–8.5 cm latae, apice longe acuminatae; *pinnae* deltatae acuminatae, saltem inferiores subopppositae, remotae (usque ad 3 cm inter se distantes), 3–4.5 cm longae, basi 2–3 cm latae, petiolatae subaequilaterales; divisiones ultimae obliquae oblongo-subfalcatae acutiusculae vel obtusae, ad marginem pilis articulatis appresse ciliatae; *costae et costulae* subtus squamis parvis brunneis apice filiformibus praeditae; *venae ultimae* vix perspicuae 1-2-furcatae supra pilis minutis appressis articulatis praeditae; *textura non-vascularis* utrinque glabra eglandulata. *Sori* parvi, plerumque uno tantum in quoque ultimo segmento; *indusium* firmum pallide brunneum glandis destitutum.

Rhizome decumbent, 7–10 mm thick, densely clothed at apex with dark yellow-brown, linear-attenuate scales to 1.5 cm long, 0.4–1 mm broad, these non-glandular and with entire margins. *Fronds* several, fasciculate, up to 30 cm long; *stipes* shorter than or equalling the blades, 6–15 cm long, deep reddish-brown, essentially eglandular, bearing numerous spreading, dark brown, filiform scales to 8 mm long, each from a minutely swollen base, the cells dense, elongate, scarcely clathrate. *Blades* 3-pinnate, lanceolate or lance-oblong, 10–17 cm long, 6–8.5 cm broad below the middle, long-acuminate at apex; *pinnae* deltate, acuminate, at least the lower ones subopposite, remote (up to 3 cm apart), 3–4.5 cm long, 2–3 cm broad at base, stalked, subequilateral; secondary divisions 7–10 pairs, the lowest ones deltate or oblong-deltate, the lowest ones of each pinna fully pinnate at base; ultimate divisions oblique, oblong-subfalcate, acutish or blunt, the margins appressed-ciliate with articulate hairs; *costae and costules* beneath bearing small brown bullate scales with hairlike tips; *ultimate veins* obscure, 1-

2-forked, bearing minute appressed articulate hairs on upper side; *tissue* glabrous and eglandular on both sides. *Sori* small, usually 1 to each ultimate segment; *indusium* firm, light brown, glabrous and without glands.

TYPE, Parish of **St. Thomas**: Old England, Blue Mts., *Harris* 12903 (JAM). The plant was collected at "3500 feet altitude, on rocky slope near the falls", Feb. 28, 1919. PARATYPES: **St. Andrew,** John Crow Peak, *Hart*, *J.P.*176, pro parte (BM, JAM). This material has slightly glandular tissue, but otherwise agrees with *C. harrisii* rather than the following species. Locality not cited: *Hart* (P).

CTENITIS **parvula** Proctor, **sp. nov.** *Nephrodium pubescens* Desv. in Mém. Soc. Linn. Paris **6**: 261 (1827), nomen nudum; non *Polypodium pubescens* L. (1759), nec *Aspidium pubescens* Swartz (1801).

Rhizoma decumbens vel ascendens, 5–8 mm crassum, apice paleis flavo-brunneis lineari-filiformibus ad 7 mm longis 0.2–0.3 mm latis eglandulatis integris dense vestitum. *Frondes* plures fasciculatae 8–23 cm longae; *stipites* laminis breviores, 3–10 cm longi, fusco-brunnei minute glandulo-puberuli paleas numerosas patentes fusco-brunneas filiformes minus quam 2 mm longas cellulis densis elongatis haud clathratis ferentes. *Laminae* bipinnato-pinnatifidae vel vix tripinnatae ambitu lanceato-oblongae vel oblongae, 6–13 cm longae, infra medium 3–5 cm latae, apice acuminatae; *pinnae* deltatae obtusae subopppositae, inferiores remotae (usque ad 3 cm inter se distantes), 1.5–2.5 cm longae, basi 1.5–2.5 cm latae, petiolatae subaequilaterales; divisiones secundariae 3–6-jugae, inferiores plerumque oblongae, pinnulis 1–2 liberis; divisiones ultimae omnes obtusae ad marginem pilis paucis minutis articulatis praeditae; *costae et costulae* subtus squamis paucis sparsis minutis brunneis bullatis clathratis apice attenuatis praeditae; *venae ultimae* manifestae supra pilos minutos appressos articulatos subtus glandulas cylindricas ferentes; *textura non-vascularis* membranacea minute sparseque glandulosa. *Sori* parvi supramediales; *indusium* pallide brunneum, glandulis parvis cylindricis dense tectum.

Rhizome decumbent or ascending, 5–8 mm thick, densely clothed at apex with yellow-brown, linear-filiform scales to 7 mm long, 0.2–0.3 mm broad, these non-glandular and entire. *Fronds* several, fasciculate, 8–23 cm long; *stipes* shorter than the blades, 3–10 cm long, dark brown, minutely glandular-puberulous, bearing numerous spreading, dark brown, filiform scales less than 2 mm long, the cells dense, elongate, not clathrate. *Blades* 2-pinnate-pinnatifid or barely 3-pinnate, lance-oblong or oblong, 6–13 cm long, 3–5 cm broad below the middle, acuminate at apex; *pinnae* deltate, obtuse, subopposite, the lower ones remote (up to 3 cm apart), 1.5–2.5 cm long, 1.5–2.5 cm broad at base, stalked, subequilateral; secondary divisions 3–6 pairs, the lowest ones chiefly oblong, with 1 or 2 free pinnules; ultimate divisions all obtuse, the margins bearing a few, minute articulate hairs; *costae and costules* beneath with a few scattered, minute, dusky brown, bullate, clathrate scales, these attenuate at apex; *ultimate veins* evident, bearing minute appressed articulate hairs on upper side and minute cylindrical glands beneath; *tissue* membranous, minutely and sparsely glandular beneath. *Sori* small, supramedial; *indusium* light brown, densely covered with small cylindrical glands.

TYPE: Parish of **St. Andrew**, "below" John Crow Peak, *Harris* 7335 (BM, isotypes JAM, K). This collection was doubtfully cited by Christensen (K.Dansk.Vid.Selsk.Skr.VIII, **6**: 39, 1920) as *Dryopteris crystallina*, but appears to differ significantly from that primarily Cuban species. PARATYPE: Locality not cited ["in jamaicae"], *ex herb. Desvaux*, apparently the basis of *Nephrodium pubescens* Desv. (P). The latter name probably represented merely a misidentification by Desvaux.

A plant with somewhat similar oblong fronds from the Cockpit Country of Trelawny (*Proctor* 4071) is probably only a juvenile phase of *C. hirta*, as shown by the structure of the scales and other characters.

GLEICHENIA PALMATA (Schaffn. ex Fourn.) C.Chr., Ind. Fil. 323 (1906). [*Mertensia palmata* Schaffner in Fée, Mém. Foug. 9: 32 (1857), nomen nudum; *Gleichenia palmata* Moore, Ind. Fil. 380 (1862), nomen nudum.] *Mertensia palmata* Schaffn. ex Fourn. in Nyl. & Besch., Mex. Pl. **1:** 137 (1872); TYPE from Jalapa, Mexico, *Schaffner* 229 (isotype K). *Dicranopteris palmata* Schaffner ex Underw. in Bull. Torr. Bot. Club **34:** 259 (1907); TYPE from Orizaba, Mexico, *Pringle* 6129 (NY, isotypes GH, IJ, K, etc.); Maxon in N. Amer. Fl. **16:** 61 (1909); *Sticherus palmatus* (Underw.) Copel., Gen. Fil. 28 (1947).

This is a peculiar case of nomenclatorial confusion. Fournier's effective publication of Schaffner's name was overlooked by Underwood in his treatment of these plants, and the latter described this entity under *Dicranopteris* with the same specific name but based on a different type. In doing this, he created a taxonomic synonym which cannot be treated as a nomenclatorial one, though the specific epithets are identical! Christensen's combination of *Gleichenia palmata* can be treated as new and valid because, although he wrongly cited "(Schaffn.) Moore" as authorities (they having published mere *nomina nuda* with no standing), he also cited the Fournier work in which a description of this species first appeared.

GRAMMITIS Swartz in Journ. Bot. Schrader 1800[2]: 17 (1801).

When separating the so-called "grammitid" ferns from *Polypodium* (in which genus they were long included), there are two possible courses of action. One is to set up a series of essentially "one-character" genera such as proposed by Copeland (*Genera Filicum*, Ann. Crypt. Phytopath, 5: 1947) and others; the other is to establish an inclusive genus for most of these obviously related ferns, separating out only the most aberrant groups at the generic level. I prefer the latter course, and some of the species occurring in Jamaica have already been transferred (Proctor in Bull. Inst. Jamaica Sci. Ser. **5:** 31–36, 1953; Rhodora **63:** 35, 1961; Brit.Fern Gaz. **9:** 8–9, 1962) to an expanded genus *Grammitis*. The remainder of the Jamaican species are hereby transferred as follows:

GRAMMITIS **aromatica** (Maxon) Proctor, **comb. nov.**, based on *Polypodium aromaticum* Maxon in Proc. U.S. Nat. Mus. **27:** 743 (1904); *P. firmum* auctt. non Kaulf. TYPE from Jamaica, *Underwood* 1449 (NY).

GRAMMITIS **brunneo-viridis** (Baker ex Jenman) Proctor, **comb. nov.**, based on *Polypodium brunneo-viride* Baker ex Jenman in Journ. Bot. **15:** 265 (1877). *Ctenopteris meridensis* sensu Copel. in Phil. Journ. Sci. **84:** 464 (1956), pro parte, non *Polypodium meridense* Klotzsch. TYPE from Jamaica, *Jenman* 32, *in* 1877 (K).

GRAMMITIS **capillaris** (Desv.) Proctor, **comb. nov.**, based on *Polypodium capillare* Desv. in Berlin Ges. Nat. Fr. Mag. **5:** 316 (1811). *P. graveolens* Baker ex Jenman in Journ. Bot. **16:** 265 (1877); *Ctenopteris graveolens* (Baker ex Jenman) Copel. in Phil. Journ. Sci. **84:** 408 (1956). TYPE from Jamaica, *ex herb. Desvaux* (P).

GRAMMITIS **chrysleri** (Copel.) Proctor, **comb. nov.**, based on *Ctenopteris chrysleri* Copel. in Phil. Journ. Sci. **84:** 448 (1956). *Polypodium chrysleri* Proctor in Bull. Inst. Jam. Sci. Ser. **5**: 48 (1953), nomen nudum. TYPE from Jamaica, *Maxon* 1524 (US).

GRAMMITIS **cretata** (Maxon) Proctor, **comb. nov.**, based on *Polypodium*

cretatum Maxon in Amer. Fern Journ. **5:** 51 (1915). *Polypodium albopunctatum* Baker ex Jenman in Journ. Bot. **15:** 265 (1877), non Raddi (1819). TYPE from Jamaica, *Jenman* 34, *in* 1877 (K).

GRAMMITIS **delicatula** (Mart. & Gal.) Proctor, **comb. nov.,** based on *Polypodium delicatulum* Mart. & Gal. in Mém. Acad. Bruxelles **15:** 35, t.7 f.1 (1842). TYPE from Oaxaca, Mexico, *Galeotti* 6378 (BR, fragm. US, isotype K).

GRAMMITIS **exornans** (Maxon) Proctor, **comb. nov.,** based on *Polypodium exornans* Maxon in Amer. Fern Journ. **18:** 47 (1928). *P. asplenifolium* sensu Jenman in Bull. Bot. Dept. Jamaica II, **4:** 123 (1897), non L. (1753). TYPE from Jamaica, *Maxon* 9185 (US).

GRAMMITIS **insidiosa** (Slosson) Proctor, **comb. nov.,** based on *Polypodium insidiosum* Slosson in Bull. Torr. Bot. Club **39:** 287, t.23, f.4–8 (1912). TYPE from Cuba, *Shafer* 8043 (NY). This species has not previously been reported from Jamaica; it is perhaps not very sharply differentiated from *G. trifurcata*. The Jamaican population occurs only in the John Crow Mountains at the eastern end of the island. Specimens seen include *Proctor* 5566, 5641, 22710, and *K. Wilson and G. Webster* 534.

GRAMMITIS **jenmanii** (Underw. ex Maxon) Proctor, **comb. nov.,** based on *Polypodium jenmanii* Underw. ex Maxon in Contr. U.S. Nat. Herb. **16:** 62 (1912). *Polypodium lasiolepis* sensu Jenman in Bull. Bot. Dept. Jamaica II, **4:** 118 (1897), excl. ref. Guadeloupe, non Mett. ex Kuhn (1869). TYPE from Jamaica, *Jenman* 25, *in* 1879 (K).

GRAMMITIS **moniliformis** (Lagasca ex Swartz) Proctor, **comb. nov.,** based on *Polypodium moniliforme* Lagasca ex Swartz, Syn. Fil. 33 (1806). TYPE from Peru, *Lagasca* (not seen).

GRAMMITIS **nubigena** (Maxon) Proctor, **comb. nov.,** based on *Polypodium nubigenum* Maxon in Contr. U.S. Nat. Herb. **17:** 599 (1916). *P. capillare* sensu Jenman in Bull. Bot. Dept. Jamaica II, **4:** 120 (1897), non Desv. (1811). TYPE from Jamaica, *Maxon* 1477 (US).

GRAMMITIS **randallii** (Maxon) Proctor, **comb. nov.,** based on *Polypodium randallii* Maxon in Amer. Fern Journ. **18:** 46 (1928). TYPE from Jamaica, *Maxon* 9280 (US, isotype IJ).

GRAMMITIS **rigens** (Maxon) Proctor, **comb. nov.,** based on *Polypodium rigens* Maxon in Proc. U.S. Nat. Mus. **27:** 741 (1904). *P. rigescens* sensu Jenman in Bull. Bot. Dept. Jamaica II, **4:** 117 (1897), non Bory ex Willd. (1810). TYPE from Jamaica, *Maxon* 1346 (US).

NEURODIUM Fée in Mém. Soc. Mus. Hist. Nat. Strasbourg **4:** 201 (1850) (as *Nevrodium*). This generic name has priority over *Paltonium* Presl. Epim. Bot. 156 (1851). The plant customarily called *Paltonium lanceolatum* (L.) Presl must therefore be known as *Neurodium lanceolatum* (L.) Fée, Mém. Foug. 3: 28 (1852).

PITYROGRAMMA **ebenea** (L). Proctor, **comb. nov.,** based on *Acrostichum ebeneum* L., Sp. Pl. **2:** 1071 (1753). *Acrostichum tartareum* Cav., Descr. 242 (1802); *Pityrogramma tartarea* (Cav.) Maxon in Contr. U.S. Nat. Herb. **17:** 173 (1913), Proctor in Bull. Inst. Jamaica Sci. Ser. **5:** 44 (1953), etc.

In a personal communication W. T. Stearn confirms my opinion that the Linnaean epithet for this species must be reinstated and points out that "Article 8 of the International Code of Botanical Nomenclature states that the author who first designates a lectotype must be followed, but his choice is superseded if it can be shown that the choice was based on misinterpretation of the protologue". In describing *Acrostichum ebeneum*, Linnaeus

had before him a specimen which still exists in the Linnaean Herbarium (sheet 1245.14, named and numbered in his handwriting); his diagnosis not only was evidently based on this specimen (which therefore must be considered the holotype), but also distinctly contrasts with that of *A. calomelanos.* Linnaeus also cited as a synonym a plant collected by Sloane in Jamaica, and illustrated by Sloane in "hist. 1. p.92. t.53, f.1". This was a misidentification, for Sloane's plant is the species now called *Pityrogramma calomelanos* (L.) Link. For a long time authors have incorrectly typified *A. ebeneum* by the Sloane plate, thereby placing the name *Acrostichum ebeneum* in the synonymy of *P. calomelanos* (for example Tryon in Contr. Gray Herb. **189:** 60, 1962). This practice must be discontinued, as a lectotype cannot properly be based on a misidentified synonym, especially when a perfectly good type specimen is available.

PITYROGRAMMA **williamsii Proctor, sp. nov.**

Rhizoma curvato-ascendens ap'ce paleis paucis occultis nitide brunneis subclathratis deltato-acuminatis ad 2 mm longis praeditum. *Frondes* numerosae dense caespitosae rigide erectae 20–35 cm longae. *Stipites* nitide purpureo-brunnei 5–10 cm longi. *Laminae* ambitu lineari-lanceolatae vel anguste oblanceolatae, 15–27 cm longae, 3.5–6 cm latae, apice acuminatae, basi angustato-attenuatae (pinnis inferioribus remotis ovato-deltatis 0.5–1 cm longis), bipinnato-pinnatifidae vel tripinnatae; *rhachis* nitide purpureo-brunnea apicem versus anguste alata, ala subtus dense flavo-pulverulenta; *pinnae* anguste deltatae, pinna longissima c. 3 cm longa 1.2 cm lata, brevipetiolatae, apice acutae; *pinnulae* e basi inaequilaterali cuneata ovato-oblongae, basi pinnatifidae vel omnino pinnatae; *segmenta ultima* flabellato-cuneata, lobis acutis; *venae* supra canaliculatae praeter apices leviter dilatatos qui desinunt versus apices loborum ultimorum. *Textura non-vascularis* rigide membranacea, atroviridis, opaca, subtus pulvere sulphureo dense induta. *Sporangia* numerosa in venis ultimis penultimisque disposita.

Rhizome curved-ascending, bearing at apex a few hidden, glossy brown, subclathrate, deltate-acuminate scales up to 2 mm long. *Fronds* numerous, densely tufted, stiffly erect, 20–35 cm long; *stipes* shining purple-brown, 5–10 cm long. *Blades* linear-lanceolate or narrowly oblanceolate, 15–27 cm long, 3.5–6 cm broad, acuminate at apex, narrowed-attenuate at base (the lowest pinnae remote, ovate-deltate, 0.5–1 cm long), 2-pinnate-pinnatifid or 3-pinnate; *rhachis* shining purple-brown, narrowly winged toward apex, the wing densely yellow-powdery beneath; *pinnae* narrowly deltate, the longest c. 3 cm long and 1.2 cm broad, short-stalked, the apex acute; *pinnules* ovate-oblong from an inequilateral, cuneate base, pinnatifid or fully pinnate at base; *ultimate segments* flabellate-cuneate, the lobes sharply acute; *veins* channelled on upper side except toward the slightly enlarged tips, which terminate near the apex of the ultimate lobes. *Tissue* stiffly membranous, dark green, opaque, densely coated beneath with sulphur-yellow powder. *Sporangia* numerous on the ultimate and penultimate veins.

TYPE: Parish of **Westmoreland**: Copse Mountain Woods, c. 1 mile W.S.W. of Rat Trap, elev. 1200–1300 ft., *Proctor* 21469, collected October 23, 1960. PARATYPES: **Westmoreland**: Enfield, 3 miles south-east of Darliston, *Proctor* 4662; Leamington, *Orcutt* 7451 (K); Chocho Gully, along road between Beeston Spring and Bog House, 4.5 miles E.S.E. of Bluefields P.O., *K. Wilson* & *G. Webster* 498 (GH). Locality not cited, *Purdie* (K). A somewhat similar and probably conspecific specimen has been collected in **Trelawny**: Cockpit Country c. 5 miles north of Quick Step, *Proctor* 4081. The latter differs chiefly in having broader, more membranous fronds bearing much less powder beneath.

Pityrogramma williamsii occurs on partly-shaded calcareous banks, and around the bases of limestone boulders in pastures at middle elevations (1100–1400 ft.), confined almost entirely to the rainy eastern portion of Westmoreland. It differs from *P. sulphurea* (with which it was formerly confused) by its stiffly erect habit, dark green narrow fronds with opaque tissue, more copious powder, and especially by the smaller, sharply acute ultimate lobes in which the veinlets run towards the tips. The veins of *P. sulphurea* always run to a small sinus. Named for Bernard Williams of Copse Mountain House, long a patron of Jamaican natural history, upon whose estate the type specimens were collected.

POLYPODIUM LEUCOSTICTON Kunze in Linnaea **20:** 380 (1847).

For many years it has been assumed that the Jamaican fern named *Polypodium microchasmum* Baker in Journ. Bot. **16:** 44 (1887), which was based on very meagre material, is synonymous with *P. plebejum* Schl. & Cham. a common and widespread plant of the moister parts of Mexico and Central America. However, on several occasions the writer has been able to collect good specimens of the rare Jamaican entity, and during the summer of 1964 (aided by a grant from the Dodge Jones Foundation, made available by C. L. Lundell) was able to observe *P. plebejum* growing abundantly in Guatemala. It has become apparent that *P. microschasmum* is not the same as *P. plebejum*, differing in the relatively short, suberect rhizome, in the structure of the rhizome-scales, and in the subdimorphic fronds with stouter and more or less winged stipes. By these characters the Jamaican plant approximates the taxon recognized as *P. leucostiction* by Maxon (Contr. U.S Nat. Herb. **17:** 572, 1916) in his treatment of this group of species. *P. microchasmum* should therefore be transferred to the synonymy of *P. leucosticton*. Maxon implied that the latter name might include dissimilar elements, but so far as I know this question has not received further study.

STIGMATOPTERIS **jamaicensis** (Desv.) Proctor, **comb. nov.,** based on *Cystopteris jamaicensis* Desv. in Mém. Soc. Linn. Paris **6:** 263 (1827). *Dryopteris nothochlaena* Maxon in Contr. U.S. Nat. Herb. **24:** 58 (1922); Proctor in Bull. Inst. Jamaica Sci. Ser. **5:** 26 (1953). Desvaux says that his plant came from "Cuba et Jamaica", but a specimen from his herbarium (probably the type) at Paris simply says "in Antillis". The species is now considered endemic to Jamaica.

THE INFLUENCE OF SHADED CONDITIONS ON THE FERTILITY OF BRACKEN

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ABSTRACT

Qualitative observations in various parts of southern England, and a few northern localities, have shown that Bracken *Pteridium aquilinum* is generally less fertile when growing in shaded situations. Measurements of the fertility of fronds growing at the edges of woods have shown a gradual decrease in fertility with increasing degree of shade. This fertility gradient showed a significant correlation with light intensity, but little or no correlation with the other habitat factors measured.

INTRODUCTION

This investigation was originally suggested by the observation, in the summer of 1959, that large bracken fronds growing under fairly dense shade in a pine plantation on the North Downs, were apparently completely sterile. Apart from brief notes on light and frond morphology (Tansley 1939), research into the extensive literature on bracken (Braid 1959) revealed little beyond a few casual remarks that "sporophylls do not occur in nature in shaded situations" (Goebel 1905, Schwabe 1951), although Conway (1957) has concluded that "fertile fronds develop in any habitat where the rhizome is well established, but that extreme conditions which retard vegetative growth, also restrict sporangial development." The only indication of a detailed investigation of the problem is a note by Conway (1957) that in "fairly thick shade" in a Stirlingshire oakwood, fronds were 21% fertile, but at the edge of the wood, 200 yards away, they were 40% fertile; no indication of the relative degree of vegetative development was given, nor any measurements of the physical factors of the habitat.

Several detailed investigations of the effect of environment on the anatomy of bracken (Boodle 1904, Woodhead 1906) show that shading does have profound effects on the bracken plant, including the loss of the leaf hypoderm, and the reduction of the palisade layer, and of cuticle and leaf thickness. These investigators also suggested that in shaded situations the number of sterile leaves is very much greater than in exposed areas, and that the sori are small with reduced marginal indusia (Boodle 1904).

Nearly all of these writers have emphasised that bracken reacts sharply to a complex of factors, the most important of which, in reference to shaded plants, being light, wind and available moisture. Unfortunately, the only attempt to measure these effects quantitatively in the field (Burke 1953), ignored this advice and gaily concluded that light was the only important factor influencing the size of shaded fronds.

The present investigation aims to demonstrate that bracken is less fertile in shaded situations, in spite of satisfactory vegetative growth, and to examine its response to varying light intensities in the field. In addition, as many of the other physical factors as possible have been measured in an attempt to sort out the complex of factors involved.

GENERAL OBSERVATIONS

The more or less complete sterility of bracken fronds when growing in shaded situations has been observed in a large number of widely differing sites, mainly concentrated in southern England but also including mixed woodland in the Lake District and in southern Scotland. Such general observations have covered a wide range of British climatic types, and also a wide range of soils, including those derived from sandstones, limestones, clays and sand, of various ages between Cambrian and Quaternary. A few examples of areas in which bracken was observed to be fertile in the open and sterile in the shade are:

(1) Michaelwood, Gloucestershire: mixed deciduous woodland on Cambrian rocks.
(2) Brean Down, Somerset: exposed and maritime, on Carboniferous limestone.
(3) Cheddar Wood, Somerset: oak-ash wood, on Carboniferous limestone.
(4) Epping Forest, Essex: beechwood on Tertiary sands.
(5) Esher Common, Surrey: oak-birch wood on Tertiary clays.

In no locality have general observations contradicted the hypothesis that bracken tends to be less fertile in shaded situations.

DETAILED OBSERVATIONS

Localities studied

Three areas were studied in detail and were deliberately chosen to contrast their geology, topography and climate. The bracken growing in a completely exposed situation on Braunton Burrows, North Devon, was examined as an example of a fairly xerophytic habitat, subject to a climate with considerable maritime influence. The edge of a mixed coniferous wood was studied in Ashton Court, Bristol, which was situated on a sandstone in the Carboniferous Limestone series. The area studied was on a 10–15° slope facing S.S.E., at an altitude of about 300 feet. The third area studied was the edge of a pine plantation on the North Downs, near Shere, Surrey, and was more or less level. The climate in this area is markedly drier, and with more extreme temperatures, than the other areas in south-west England. The geology was the clay-with-flints of the chalk plateaux, and the altitude was about 600 feet.

Results

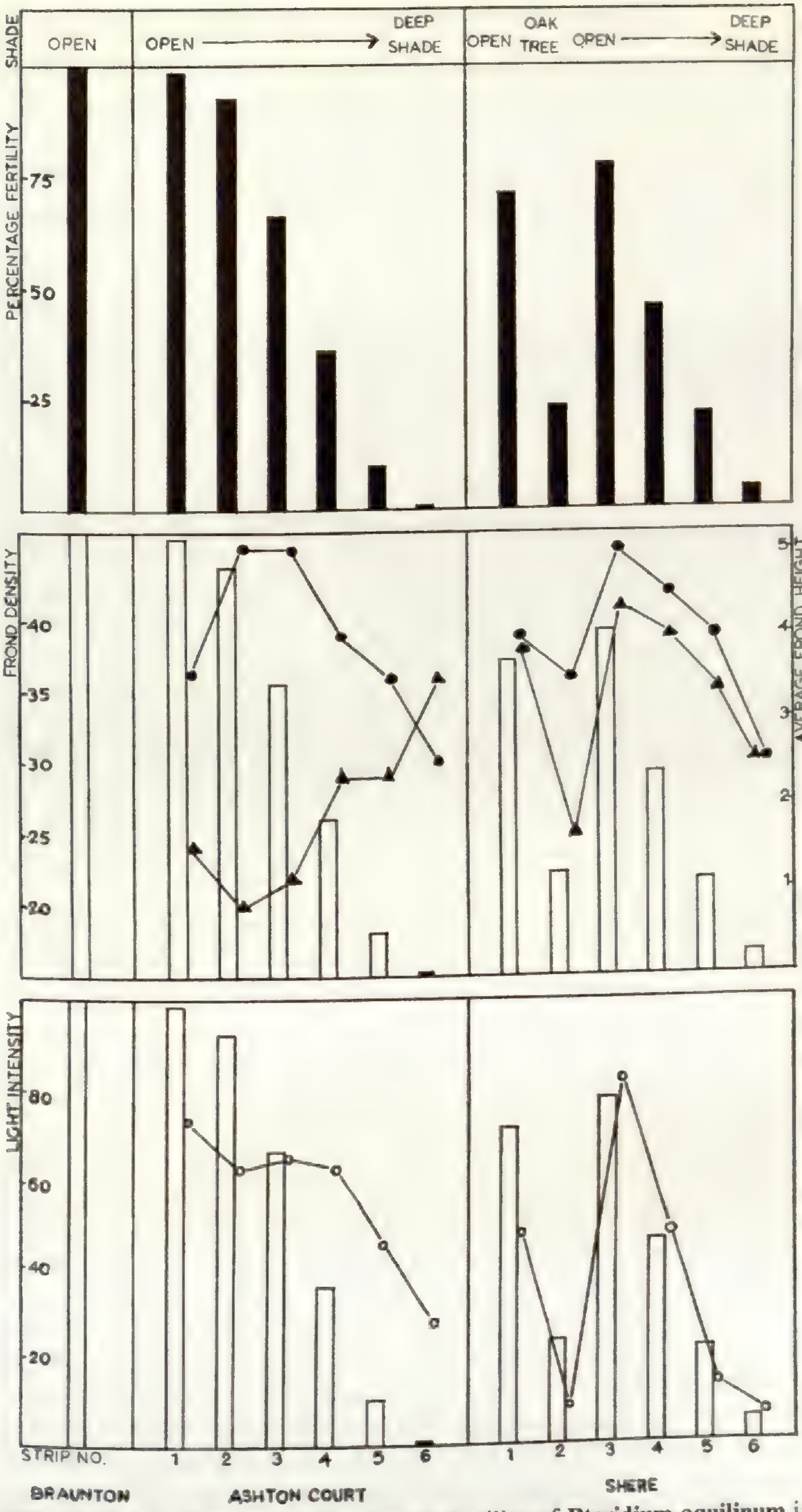
The measurements of fertility in the three areas (FIG. 1) demonstrate the degree of response—a reduction to less than 5% of full fertility in dense shade—and also demonstrate that the effect is graded according to qualitative estimates of the degree of shading.

The numbers 1 to 6 for the Ashton Court and Shere data represent strips about three yards wide and six yards apart, which were drawn at right-angles to the transect line, but parallel to the edge of the wood. All plant and habitat measurements were taken at random within each strip. As the population at Braunton was all fully exposed, samples were taken at random throughout the area.

A reliable and convenient measure of the frond fertility was worked out with some difficulty. Initial observations soon established that fronds could not be simply classified as either fertile or sterile, but the degree of fertility of the basal pinna was found to be a reliable guide to the fertility of the whole frond. The development of a marginal indusium was taken to indicate potential fertility, and the number of the basal ten segments of a standard pinnule which showed such development was counted. This gave a value of 0 to 10, which could be rapidly transformed into percentage fertility. The standard pinnule used was the second lower pinnule of the bottom left-hand pinna.

Having established that bracken shows a gradual decrease in fertility when growing in increasingly dense shade, an attempt was made to elucidate the factors controlling this effect, whether acting directly, or through the restriction of vegetative development. The factors considered in detail were the degree of vegetative development, edaphic factors, humidity and light intensity.

Three measures of vegetative development were used, none of which were entirely satisfactory. The length of the standard pinnule was measured, but this often gave a poor estimation of the size of the frond as a whole, and certainly showed no correlation with the percentage fertility. The average height of the fronds and the number of fronds growing within a circle of one metre diameter, were also measured in each strip. The results are shown in FIG 2. It is clear that in both the Ashton Court and Shere areas the average frond height shows a positive correlation with fertility although individual fronds growing in deep shade occasionally reached heights of six feet or more. This reduction in the average height of the shaded fronds was associated with a change in morphology. In deeply shaded fronds the angle between the basal pinnae at the point where they join the rhachis was obtuse, usually between 135° and 180°, whereas in exposed fronds the angle was more acute, between 60° and 120°. Thus the pinnae of shaded fronds appeared to lie all in one plane, often at about 45° to the horizontal, whereas only the upper pinnae of exposed fronds lie in one plane, and the lower are borne on an erect rhachis. In addition the shaded fronds are a much paler



FIGURES 1–3 Histograms showing % fertility of **Pteridium aquilinum** in relation to shade; FIG. 2 shows correlation with vegetative development (●—● frond height in feet; ▲—▲ frond density in number per quarter circle of 1 metre diameter), FIG. 3 correlation with light intensity as % of full light (o—o).

green and show a marked reduction in thickness.

The Ashton Court graph shows a negative correlation between frond density and fertility, but this trend is contradicted by the Shere data, so that little can be concluded on the relationship between the two.

Thus there appears to be some degree of correlation between fertility and the size and morphology of the fronds, but a more exact measure of vegetative development is required before this can be assessed in any detail. Conway (1957) suggests that restricted rhizome growth will retard both vegetative growth and sporangial development, so that a direct measure of rhizome size and vigour may have to be employed in future investigations.

Only a preliminary and rather unsatisfactory investigation of the edaphic factors in the Ashton Court and Shere areas was carried out, in which the soil reaction and the moisture content of the top-soil and sub-soil were measured. The results indicated that the less fertile fronds were growing in soils of high acidity and with high moisture and humus contents. In view of previous work on bracken, it seems likely that moisture content is the most important of these three factors, and it is possible that the slightly higher moisture contents recorded for woodland soils caused a reduction of rhizome vigour sufficient to account for the observed reduction of frond size and fertility. This interpretation would imply a reduction in fertility at the margins of waterlogged areas where rhizome growth should be similarly restricted, and is supported by Conway's observation that a sand-dune population was sterile when exposed to a high brackish-water table (Conway 1957). A more detailed investigation of the degree to which edaphic factors change at the edges of woods is also required.

The humidity of the air in deeply shaded situations will obviously be greater than in the open, but it is perhaps doubtful whether significant changes occur over the distances in which these steep fertility gradients have been recorded. Some readings taken in Ashton Court with a whirling hygrometer were interesting in that they showed no such changes, but as they were taken after a fairly long, dry spell, it is possible that more abrupt changes might be recorded in more normal climatic conditions.

The intensity of the light is the most obvious of the possible factors affecting the fertility of the fronds, but this does not necessarily mean that it is the most important. If measurements of light intensity can be made in different areas in such a way that the readings can be directly compared, some idea of its importance in relation to other physical factors may be obtained. The exact comparability of the readings is vital, and, as slight variations in atmospheric conditions and in the way the readings are taken cause violent fluctuations of value, this is extremely difficult to achieve. Unfortunately, in this investigation different instruments had to be used in the two areas. In Ashton Court light intensity was measured by means of an Eel light meter, and at Shere a Weston Universal Exposure Meter was used. The readings were taken at frond level at about noon on bright

summer days, and the values plotted are the averages of fifty readings taken in each strip. In order that the two sets of data should be more nearly comparable, the results are expressed as a percentage of the light intensity in the open.

However, it is doubtful whether a reading taken at any one time bears much relation to the light actually received by the plant during the course of the year. The use of hemispherical photographs to estimate both diffuse light and direct sunlight, as described by Anderson (1964), is one very simple and promising method of measuring the total effective light received by the plant, and another is described by Dore (1958), but similar problems apply also to the other constantly changing physical factors of a micro-habitat, humidity and temperature, and until these are solved critical analysis of the detailed relationships of these factors is impossible.

Bearing such reservations in mind, it is worthwhile to consider the information which can be gleaned from the data obtained in this investigation. Assuming that the two sets of data, when expressed as percentages of light intensity in the open, are comparable, it is noticeable that the fronds show different degrees of response to light intensity (FIG. 3). Thus the Ashton Court fronds seem to show a greater range of fertility in response to a smaller range of light intensities. This would suggest that light is not the sole controlling factor, and that the differences in response are due to some other factors, such as soil, climate or vegetative development, which are contrasted in the two areas. If more detailed and reliable information about two more directly comparable areas was obtained, this variation in the degree of response to light could be confirmed, and the data could be subjected to statistical analysis to determine the effects of pairs, or larger combinations, of factors on the fertility of the bracken fronds.

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NOTES AND REVIEWS

SPORELING BRACKEN ON LITTLEWORTH COMMON

A NOTE ON ECOLOGY OF BRACKEN

The sexual stage in the life-history of Bracken *Pteridium aquilinum* is usually found only in protected, sterilised and alkaline sites, and where the spore is able to make direct contact with a suitable substrate. Rarely, as at Littleworth Common near Esher in Surrey in 1960, conditions are favourable and the full life-cycle of bracken is completed.

The summer of 1959 was very dry in England, only some 3.6 inches of rain being recorded at Kew Observatory from May to mid-September; normally, nearly 10 inches would have fallen in the same period. As a result, trees dropped their leaves and Bracken *Pteridium aquilinum* and grass turned brown and died off early. In this premature autumn, heaths and woodlands were tinder dry and many were burnt by fire. One such was Littleworth Common where about one acre of heathland was partially destroyed. This area of the common, about 50 feet above sea-level, consists of fairly widely spaced birch trees with bracken and *Molinia caerulea* in the herb layer. The soil is sandy and partially leached with a small dispersed iron pan and about two inches of peat on the surface. The fire, which was observed only in its dying stages on October 18th, progressed erratically leaving "islands" of bracken in some places while burning away the peat to expose the mineral soil in others. Some of the birch trees were blown down by later autumnal gales, after having had their major roots (in the top 12 inches of soil) destroyed by the fire to leave only smaller roots penetrating deeper. The immediate effect of the fire was to provide an open habitat ready to be colonised anew and also to stimulate fresh growth on those plants which had survived; *Molinia caerulea* and *Potentilla* sp. sprouted leaves, seeds germinated and the remaining birches developed buds at the bases of their trunks. (In the following spring and summer most of the bare ground was colonised with seedlings, mainly by wind-dispersed seeds such as of birch and rosebay-willowherb). On December 13th the first organism of an unusual type seen was a fungus *Anthracobia melaloma*, a discomycete with an orange ascocarp up to 5 mm in diameter, growing in small clumps on the blackened soil; by the first week in February it was being overgrown by a filamentous green alga *Ulothrix* sp., and a second species *Anthracobia macrocystis*, lemon yellow in colour, was thriving.

Young bracken prothalli and moss protonema also appeared at the beginning of February 1960, as green patches on charcoal left by the fire. During the last two weeks of January the average minimum temperatures had been 35 and 34 (lowest 28 and 30) degrees Fahrenheit, but now a cold spell set in for a week and the temperature was 29 (26). Although the weather proceeded to warm up, only 1°F of frost being recorded once at Kew between then and the summer, further bracken prothalli were not seen

until mid-April. The moss protonema appeared more hardy as they continued to gow. Conway found that bracken prothalli could survive several degrees of frost and a covering of snow but that dry cold was quickly fatal. It is possible that it was partly through desiccation that these prothalli died. They were usually found in small sheltered patches such as in a footprint or under the collapsed dead fronds of the previous year's growth where the humidity was presumably higher. Bracken sporelings were up to two inches high by the end of May and were growing in competition with a flush of seedlings which included birch, rosebay-willowherb, groundsel, gorse and poplar. The *Anthracobia* had disappeared and instead grew another orange fungus of similar appearance *Pyronema confluens* and a small brown agaric *Flamula carbonaria*. The first sporophyte fronds of bracken are pale green and simple in shape; later ones are pinnate and there is a gradual increase in size and complexity. After four months they were up to 18 inches high and approaching mature fronds in shape though still more delicate and of a lighter green. An interesting point is that each plant had two rhizomes set rigidly at about 90°–100° to each other which grew downwards into the soil and levelled off at their normal depth of six inches.

When the area was revisited four-and-a-half years later it was predominantly covered by eight-foot saplings, mainly birch with a few willow and aspen. Some of the original bracken was left, as well as Molinia and birch and oak trees. Leaf-litter removed by the fire had reaccumulated and the ground was partially moss-covered. There was no apparent way of distinguishing mature sporelings from original bracken, except by locality. Mature bracken fronds appeared between birch saplings on areas which had previously been swept clear by the fire. It seems probable that this particular area will develop into a thicket of trees much like some other areas on Littleworth Common.

Ecology of the Bracken gametophyte

The sexual stage in the life-history of bracken is usually found only in protected, sterilised and alkaline sites. Such sites, as noted by Conway, are usually on burnt ground, in damp hollows (such as quarries and embankments), and on old walls or rubble (such as bombsites). One reason given by Braid for this scarcity is that flowering plants and mosses produce substances which somehow inhibit the growth of the bracken prothalli. Conway found that bacteria, moss protonema and especially algae have marked suppressing effects on bracken prothalli but she queried as to whether this was due to competition for nutrients. Also, alkalinity is found to favour their development (optimum range is pH 5–7) and potash is found in high concentration in bracken tissues; it would be released into the soil when the plant is burnt and this seemed to be corroborated by a higher pH on the burnt area. In similar, but unburnt areas, the pH was 5.5–5.6 in the top 8 cms of soil The burnt land was pH 6 on the surface and pH 5.5 at 8 cms depth. This measurement was taken in June 1960 and some leaching probably

occurred during the winter. However, the fact that bracken spores developed on this burnt area and not elsewhere in the vicinity may be due simply to the direct contact the spore was able to make with the soil. The spores are small and are not equipped for prolonged growth without water and nutrients. Normally, the soil is covered by other plants or loose leaf litter which prevents the rhizoids of the prothallus from contacting soil or similar moist substrate. Occasionally, as at Littleworth, this surface covering is removed and the full life-cycle of the plant is completed.

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THE FERNS IN *FLORA EUROPAEA*

FLORA EUROPAEA Volume One. Lycopodiaceae to Plantanaceae; *edited by T. G. Tutin, V. H. Heywood, N. A. Burges, D. H. Valentine, S. M. Walters and D. A. Webb with the assistance of P. W. Ball and A. O. Chater; xxxii* [+*ii*] + 464 [+4] pages, 5 maps, 22 × 28 *cm; Cambridge, University Press,* 1964; 84 *shillings net.*

Review of the chapter on ferns*

For every scientist or amateur interested in present-day living vascular plants, the publication of the first of four volumes of Flora Europaea is a most welcome event. It is true that among the five inhabited continents of our globe, the flora of Europe is still the best known. Nevertheless the enterprise was very big and difficult and the editors can be congratulated on their optimism. The outcome shows that scientific efforts and goodwill are still able to overcome old and new political and cultural barriers, including linguistic problems. The result is a compromise in the best sense of the word, being an opus in which diverse and often contradictory necessities, e.g. detail as well as conciseness, are well balanced. This is also true of the taxonomy which is both modern and practical in the sense that classical methods based on morphology, as far as possible, are supplemented by results deduced from cytology and experimental taxonomy. For every species keys, descriptions, geographical distributions and, if possible, chromosome numbers are given. Such data are also given for recognised subspecies. The more common hybrids are mentioned as well as taxa of doubtful status. This should encourage further studies of the latter.

Flora Europaea begins with Pteridophyta (pages 1-25), of which pages 8-25 are devoted to ferns proper (Filicopsida), divided into 21 families. To produce the treatment of Filicopsida, contributions are combined from the following scientists (in alphabetical order): A. O. Chater, J. A. Crabbe, H. P. Fuchs, V. H. Heywood, A. C. Jermy, A. Lawalrée, J. D. Lovis, W. Rothmaler(†), T. G. Tutin, D. H. Valentine, T. G. Walker and D. A. Webb.

* F. A. Stafleu has reviewed the whole of Vol. 1 in *Taxon* **14**: 105-107 (1965)

Europe, when compared with other continents, is very poor in ferns. Altogether, some 100 good species truly native to Europe are described, as well as 6 more (including 5 aquatic) naturalized species introduced by human activities. The British, as well as the continental, fern hunter will find even this a bigger number than expected. It is explained by the fact that about 20 are either very rare or very local or confined to remote places, so that hardly any pteridologist has ever seen all of them growing in their natural habitat. The Azores alone give shelter to 7 species not found in other parts of Europe as delimited in the Flora.

Taken as a whole this chapter on Filicopsida is an excellent piece of work, giving most important information in condensed form. It will be indispensable for everybody interested in ferns, whether living in Europe or in other continents. It is to be hoped that it may also help, at least to a certain degree, to bring some stability in the nomenclature of ferns.

The following remarks from a non-professional but enthusiastic amateur of ferns are offered for consideration for any addendum or new edition; provided interest in the Flora proves to be as great as is expected, a new edition may be necessary quite soon.

Remarks

In some few cases the Flora gives extra-European distribution in parenthesis. I regret that this very useful information is not extended to more, if possible to all species. I would also welcome "apogamous", after the chromosome number of obligate apomicts; it is given for *Pteris cretica* but not for all known cases; this property is often quite important to understand particular distribution patterns and the forming of local clones with distinct morphology. I wonder how long our well known Beech Fern (*Phegopteris*) will really feel happy in *Thelypteris*. Under *Dryopteris abbreviata* (DC.) Newman, the indication "sori usually . . . 1–2 (–4) on each pinnule" corresponds to De Candolle's original diagnosis but is correct only for dwarf plants; well developed plants from Spain, France and Italy invariably had 6–8 sori on each of the longer pinnules (see pictures, Reichstein 1962). Probably most Swiss botanists will not agree that the alpine strains of *Woodsia glabella* R.Br. should be separated specifically, as *W. pulchella* Bertol., from North-American and some Scandinavian elements, as suggested by Poelt (1952, 1954); they tend to accept them as conspecific, in agreement with Meyer (1959) and Brown (1964); experimental taxonomy may well help to settle this question and find the reason for some morphological peculiarities in certain northern forms. Pteridologists in Switzerland will also regret the revalidation of the name *Polystichum aculeatum* (L.) Roth for the Hard Shieldfern; perhaps this could not have been avoided, in accordance with the International Code of Botanical Nomenclature, and may even correspond to British usage; it will, however, perpetuate existing difficulties in evaluating the meaning in older continental European literature, where the same name was not only used indiscriminately for both species but, even when used specifically, was much more frequently attached to *P. setiferum* and not to the species which we would have preferred to call

P. lobatum (Huds.) Chev. in agreement with Janchen (1963). In the distribution of some species of *Asplenium*, a few minor errors may be mentioned. For *A. obovatum* Viv., Portugal is given twice; according to Pinto de Silva (1959) and Fernandes (1960) this species probably does not grow in Portugal; if this is true, it would be confined to mediterranean coasts. For *A. billotii* F. Schultz, Switzerland (where a few plants are still growing, see literature and pictures in Manton & Reichstein 1962) was not given, and Germany is given in error; the locus classicus (near Wasigenstein, Alsace) has been French territory since 1918; the fern is not known within today's frontiers of Germany (teste A. Schumacher in litt. 17.XII. 1964). Switzerland is also not given for *A. onopteris* L. where it is not uncommon in the Tessin and is also reported from the Misox (Becherer 1959) and the Puschlav (Becherer 1950). It is true that in some cases a sure differentiation between *A. onopteris* and *A. adiantum-nigrum* may require cytological investigation, and the whole complex needs further, particularly experimental study; therefore not all distribution records for these two species are reliable; in well-developed plants, like those found in southern Switzerland, it is usually quite easy to distinguish *A. onopteris* from *A. adiantum-nigrum*, but in small or dwarf specimens this may become very difficult or even impossible; macrosocopic morphology is not reliable in such cases; spore size is helpful, but the chromosome number is most reliable.

There are some ferns which, for editorial reasons, are not included in Flora Europaea. One such case is *Dryopteris remota*, and I take this opportunity to append the following remarks:

In spite of its doubtful status, *D. remota* (A.Br.) Druce could have been mentioned, although this would have raised some unsolved taxonomic questions (see Gätzi 1961). Not only have different taxa been described under this name (see Manton 1938, 1950) but probably the same slightly variable taxon is described under different names, including some of those given by Rothmaler (1945, 1963). What I mean by *D. remota* is the triploid apogamous plant, most probably of hybridogenic origin, widely distributed and not too rare, at least on the continent. It grows usually in small groups and produces viable spores (Fischer 1909, 1919; Waldmann 1928; Döpp 1932), thus behaving like a true species. It most probably corresponds to the plants collected by A. Braun in the Black Forest and also to *var. subalpinum* Borb. (1876). It has nearly always been assumed to be a hybrid. This is most probably correct, but so far nobody could prove that it is a recent hybrid originating where it is found. Out of the many different pairs of species suggested as putative parents and attached to different binomials, only one could give rise to an apogamous triploid of the particular morphology in a simple way. As long as no diploid ancestor of *Dryopteris carthusiana* is found growing on the continent, the only theoretically possible and suitable combination (as pointed out by Gätzi 1961) would be *D. assimilis* Walker × diploid *D. borreri* Newm., provided *D. remota* really originates from two

species both of which are still growing in Europe. An apogamous hybrid producing viable spores and therefore behaving to some extent similarly to *D. remota*, but much more frequent, is *Dryopteris* × *tavelii* Rothm. of which tetraploid and pentaploid forms are known, as mentioned in the Flora. Both have successfully been produced by experimental hybridisation of *D. filix-mas* with diploid and triploid *D. borreri* respectively (Döpp 1941, 1955). This shows that the apogamous nature is inherited from *D. borreri* as one parent in at least this particular case.

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A FOURTH SUPPLEMENT TO CHRISTENSEN'S INDEX

INDEX FILICUM, SUPPLEMENTUM QUARTUM PRO ANNIS 1934–1960 (*Regnum Vegetabile vol.* 37), *prepared by Rodolfo E. G. Pichi-Sermolli with the collaboration of F. Ballard, R. E. Holttum, H. Ito, F. M. Jarrett, A. C. Jermy, E. A. C. L. E. Schelpe, M.-L. Tardieu-Blot, R. M. Tryon, being the Committee for the Index Filicum of the International Association for Plant Taxonomy; xiv*+370 *pages*, 16×24 *cm; Utrech; International Bureau for Plant Taxonomy and Nomenclature, January* 1965; *price* 40 *Dutch florins.*

Supplements to the *Index Kewensis* issued at approximately five-yearly intervals keep phanerogamic botanists informed of new names and transfers relating to the genera and species of flowering-plants. Pteridologists are less fortunate. The third supplement to Christensen's *Index Filicum* (1905–06), which is the pteridological counterpart of Jackson's *Index Kewensis* (1893–95), appeared in 1934. This fourth supplement is accordingly a massive work and its compilation has certainly been a massive task. The original *Index Kewensis* owed its origin to Charles Darwin who in 1881 made known that he was willing to finance the compilation of a list of flowering-plants to supplement Steudel's *Nomenclator botanicus*, second edition (1840–41). Unfortunately Steudel's work did not cover the names of ferns and Darwin himself was not particularly interested in them. B. Daydon Jackson, whom Sir Joseph Hooker suggested as a suitable person for such an undertaking, proposed that this should not be a simple list of names with synonyms under each, supplementing Steudel's work and in the same style, but should list all generic and specific names of flowering-plants from those of Linnaeus onwards and should state their places of first publication. Jackson began work at Kew in January 1882 and, helped by eleven assistants, had the first instalment ready for printing in 1891. It was published between 1893 and 1895 and named the *Index Kewensis*. Jackson's index, by providing references to places of publication, soon proved an invaluable guide to the literature of flowering-plants and set the style for other lists of plant-names. It stimulated the Danish botanist Carl F. A. Christensen (1872–1942) to compile his similar index of the names of pteridophytes, followed by supplements in 1913, 1917 and 1934. The public-spirited Carlsberg Foundation of Copenhagen acted the part of Darwin in promoting its compilation.

The *Index Filicum*, like the original *Index Kewensis*, set out to be both an index and a nomenclator, i.e. not only to list published names but to establish correct names and reduce others to synonymy. As regards genera, Christensen followed Diels' work in Engler and Prantl's *Pflanzenfamilien*, just as Jackson had followed Bentham and Hooker's *Genera Plantarum*. As regards species he followed the latest monograph when one was available, using Jenman's work for West Indian species and Beddome's for Indian species. Since Christensen published his last supplement in 1934, many alterations have been made to Diels' classification, notably by Ching, Copeland and Holttum, and many new species have been described. To these the fourth supplement of the *Index Filicum* provides a guide which will soon be found to be indispensable. Largely this is the work of Professor Pichi-Sermolli, with the co-operation of other pteridologists, and is based on a card-index maintained at Kew by F. Ballard. It lacks a statistical summary such as Christensen gave in his work, possibly because this supplement wisely does not attempt to be more than an index, but apparently for every new species of pteridophyte described in the years 1934–60 there has been a change of classification or nomenclature necessitating a new combination or a new name for a species already described.

As regards citations, this supplement follows the New York Botanical Garden guide to citation appended to the *International Code of Botanical Nomenclature*. This means that it fails to distinguish between periodicals and isolated independent works, a distinction of great importance to librarians. Thus, we have as references: Ching, Sunyatsenia 5:261; Holttum, Rev.Fl. Mal. 2:162; Krajina, Stud.Bot.Čechosl. 1:94. A librarian will search in vain for a work by Ching called *Sunyatsenia* or by Krajina called *Studia Botanica Čechoslovaca* or for a periodical whose title might be abbreviated to *Rev.Fl. Mal.*; the insertion of 'in' before the name of the periodical in which the author published obviates ambiguity. Fortunately, this supplement concludes with a catalogue of literature for the period 1934 to 1960, which not only includes taxonomic papers but also a number on dates of publication, together with an index of abbreviations of names of botanical authors and an index of abbreviations of names of periodicals; botanists concerned with flowering-plants will also find these useful.

Compilation of the supplement was completed by April 1964. In accordance with the 1961 *International Code of Botanical Nomenclature*, names of bigeneric hybrid groups originally published without a description are here treated as *nomina nuda* and are printed in italic capitals, unlike validly published names which are printed in bold-face. At the International Botanical Congress at Edinburgh in August 1964, the relevant article (40) of the International Code was modified to the effect that for purposes of valid publication the name of a hybrid group of generic rank which is a condensed formula or equivalent to a condensed formula must be published with a statement of the parent genera but a description is not necessary. Hence, such names as × *Asplenicystopteris* P.Fournier, being a condensed formula *Asplenium* × *Cystopteris*, and × *Asplenosorus* Wherry, being a condensed formula *Asplenium* × *Camptosorus*, are now accepted as validly published. On the other hand, names of hybrids of specific or lower rank with Latin epithets are subject to the same rules as are those of non-hybrid taxa of the same rank, which means that names of Latin form for these must be published with a Latin description, the type being designated.

This fourth supplement to Christensen's monumental work reflects great credit upon all concerned with its production. Its coverage seems to have been very thorough and its compilation accurate and it is excellently printed, thus making it a reference tool both easy and pleasant to use.

British Museum (Natural History), London WILLIAM T. STEARN

THE SOUTHPORT FLOWER SHOW 26—28th AUGUST 1964: FERN CLASSES

Judges' report (by R. Kaye, President of the British Pteridological Society): Mr W. G. Mackenzie (Curator of Chelsea Physic Garden) and I were both immediately impressed by the quantity, variety and improved appearance of the fern exhibits which were better groomed and much cleaner than last year, and in general were a credit to their owners; it is by no means an easy task to lift, pack and travel with a collection of ferns without damaging them. In several cases competition was keen and we had a difficult task to allocate the placings.

Mr Brookfield had no competition for Class 8, but richly deserved First Prize; his group included some magnificent *Polypodium vulgare* varieties, several fine *Athyrium filix-femina* varieties such as 'Clarissima', 'Victoriae', 'Plumosum Druery' and 'Plumosum Percristatum'; *Polystichum* varieties included good examples of *P. aculeatum* 'Pulcherrimum Bevis' and 'Gracillimum Druery'; the exhibit attracted considerable interest and Mr Hayhurst, who spent most of the three days in the Fern Tent, was kept very busy answering questions about it and the other fern exhibits.

The prizewinners and their entries in the other Classes are listed below. There were some very fine plants among them, involving much careful cultivation often for many years; among those which impressed us most were: the British species of Mr Jackson (Classes 15 and 16); the hart's-tongues of Messrs Almond and Hayhurst (Class 10); the entries of *Athyrium*, *Dryopteris* and *Polypodium* in Class 9 which was particularly popular; Mr Hayhurst's *Adiantum* 'Kensington Gem' (Class 19) which we recognised from previous shows and which is a tribute to its owner; Mr Plowman's *Adiantum* 'Fritz Luthi' (Class 19); Mr Brookfield's *Polypodium vulgare* 'Hadwinii' (Class 11); and in Class 17 Mr Hayhurst's *Phyllitis scolopendrium* 'Crispum' about three feet in diameter and in perfect condition. Class 18 attracted only two entries.

When entering a Class for more than one fern, make sure that each specimen is as good as possible, because no specimen can gain more than its proportion of the total points. Damaged fronds were evident on several plants, particularly *Polystichum* in Class 12. A little grooming might have saved the largest specimens in Class 18 from being placed Second because of damaged and discoloured fronds. Some of the best plants in Class 13 were spoilt by weathering of the fronds; although this is difficult to avoid in late August, it downpoints in the judging.

The British Pteridological Society's Information Bureau (report by R. Kaye and N. Robinson): as in former years, the Society is indebted to the Southport Show Committee for providing free space in the marquee devoted to horticultural societies. Many thousands saw the Bureau and many hundreds of enquiries about ferns and the Society were answered by Messrs Almond,

Brookfield, Hayhurst, F. Jackson, J. Jackson and Robinson. For the first time the Bureau was decorated with an L-shaped limestone rockery set with dwarf varieties of British ferns. Great interest was aroused, many wanted to buy *Polypodium vulgare* 'Trichomanoides', and it remains to be seen how many new members were recruited. Despite a greatly increased interest in ferns from a few years back, it seems that something additional is needed to crystallize interest into membership; for this reason a discussion was held during the Annual Excursion at Brantwood to find means of making the Bureau more effectively attractive; as a result of the Brantwood discussion hopes are high for the Bureau's future achievements.

Prizewinners and their entries (reported by N. Robinson, Northern Meetings Secretary of the British Pteridological Society):

CLASS 8 A group of hardy British ferns, with accent on diversity and variation, arranged in a natural manner in a space 13 feet by 8 feet and not higher than 6 feet above the ground:

1st Messrs J. Brookfield & Son who continue to hold the Silver Perpetual Challenge Trophy presented by the British Pteridological Society.

CLASS 9 Six dissimilar hardy British ferns with accent on variation:

1st Messrs Brookfield: *Athyrium filix-femina* 'Congestum Paul', *A.f-f* 'Plumosum Druery', *Polypodium vulgare* 'Elegantissimum', *P.v.* 'Hadwinii', *Polystichum aculeatum* 'Gracillimum', *P.a.* 'Pulcherrimum Bevis'.

2nd F. Jackson: *Athyrium filix-femina* 'Acrocladon', *Dryopteris* 'Cristata', *Osmunda regalis* 'Cristata', *Phyllitis scolopendrium* 'Grandiceps', *Polypodium vulgare* 'Cambricum', *Polystichum aculeatum* 'Pulcherrimum Bevis'.

3rd B. Hayhurst: *Athyrium filix-femina* 'Frizelliae', *Dryopteris* 'Ramosissima', *Phyllitis scolopendrium* 'Drummondiae', *Polypodium vulgare* 'Pulcherrimum', *Polystichum setiferum* 'Divisilobum Densum', *P.s.* 'Imbricatum Densum'.

CLASS 10 Three distinct varieties of *Phyllitis scolopendrium:*

1st B. Hayhurst: 'Alba', 'Ramo-marginata', 'Speciosa'.

2nd N. H. Almond: 'Crispa', 'Drummondiae', 'Ramo-marginata'.

3rd Messrs Brookfield: 'Crispa', 'Cristata', 'Sagittato-cristata'.

CLASS 11 Three distinct varieties of *Polypodium vulgare:*

1st Messrs Brookfield: 'Bifido-multifidum', 'Cornubiense', 'Hadwinii'.

2nd B. Hayhurst: 'Grandiceps Cowan', 'Hadwinii', 'Pulcherrimum'.

3rd N. Robinson: 'Cambricum' (hard form), 'Cornubiense', 'Cristata' (good form).

CLASS 12 Three distinct varieties of *Polystichum:*

1st N. Robinson: *P. aculeatum* 'Pulcherrimum Bevis', *P. setiferum* 'Divisilobum Grandiceps Jones', *P.s.* 'Divisilobum Iveryanum'.

2nd Messrs Brookfield: *P. aculeatum* 'Gracillimum', *P. setiferum* 'Acutilobum', *P.s.* 'Acutilobum Densum'.

3rd B. Hayhurst: *P. aculeatum* 'Pulcherrimum Bevis', *P. setiferum* 'Divilobum Iveryanum', *P.s.* 'Hirondelle'.

CLASS 13 Three distinct varieties of *Athyrium filix-femina:*

1st B. Hayhurst: 'Frizelliae Capitatum', 'Frizelliae Cristatum', 'Victoriae'.
2nd N. H. Almond: 'Cristatum','Plumosum Superbum Druery', 'Victoriae'.
3rd Messrs Brookfield: 'Acrocladon', 'Congestum Paul', 'Plumosum Cristatum'.

CLASS 14 Three distinct varieties of *Dryopteris* (including *Gymnocarpium* and *Thelypteris*) (all exhibits were *Dryopteris*):

1st F. Jackson: 'Crispatissima Grandiceps', 'Lineata Cristata', 'Ramocristata'.
2nd B. Hayhurst: 'Angustata Cristata', 'Depauperata Cristata', 'Ramosissima'.
3rd N. H. Almond: 'Angustata', 'Angustata' (dwarf form), 'Lineata Cristata'.

CLASS 15 Three distinct varieties of *Asplenium* (some distinct species were submitted):

1st F. Jackson: *adiantum-nigrum*, *trichomanes* 'Cristata', *viride* 'Cristata'.
2nd N. Robinson: *ruta-muraria*, *septentrionale*, *viride*.
3rd Messrs Brookfield: *adiantum-nigrum*, *trichomanes*, un-named variety.

CLASS 16 Three distinct normal species of hardy British ferns:

1st F. Jackson: *Asplenium trichomanes*, *Dryopteris dilatata* ("subspecies"), *Woodsia ilvensis*.
2nd Messrs Brookfield: *Gymnocarpium dryopteris*, *Polypodium vulgare*, *Thelypteris palustris*.
3rd: N. Robinson: *Blechnum spicant*, *Dryopteris carthusiana*, *Polystichum setiferum*.

CLASS 17 One British fern, any kind or variety:

1st B. Hayhurst: *Phyllitis scolopendrium* 'Crispa'.
2nd Messrs Brookfield: *Athyrium filix-femina* 'Plumosum Cristatum'.
3rd N, H. Almond: *Athyrium filix-femina* 'Cristatum'.

CLASS 18 Six dissimilar greenhouse ferns:

1st Messrs Brookfield: *Adiantum* 'Kensington Gem', *Davallia canariensis*, *Nephrolepis* 'Cristata', *Pellaea rotundifolia*, *Platycerium alcicorne*, *Polypodium aureum* var. *areolatum*.
2nd B. Hayhurst: *Adiantum cuneatum*, *Cyrtomium falcatum*, *Lomaria gibba*, *Nephrolepis* 'Cristata', *Nephrolepis exaltata*, *Platycerium alcicorne*.

CLASS 19 Three dissimilar greenhouse ferns:

1st Messrs Brookfield: *Adiantum* 'Kensington Gem', *Davallia canariensis*, *Platycerium alcicorne*.
2nd B. Hayhurst: *Adiantum* 'Kensington Gem', *Nephrolepis* 'Cristata', *Onychium japonicum*.
3rd Barnes: *Adiantum cuneatum*, *Nephrolepis exaltata*, *Nephrolepis* 'Plumosum'.

CLASS 20 One greenhouse fern:

1st B. Hayhurst: *Adiantum* 'Kensington Gem'.
2nd Plowman: *Adiantum* 'Fritz Luthi'.
3rd Messrs Brookfield: *Adiantum* 'Kensington Gem'.

BRITISH PTERIDOLOGICAL SOCIETY MEETINGS IN 1965

IMPERIAL COLLEGE OF SCIENCE & TECHNOLOGY, LONDON SW7, 14 March. An account illustrated with colour-slides by Mr A. C. Jermy on his plant-collecting visit to Trinidad in the summer of 1963, followed by a conversazione and exhibits.

ROYAL BOTANIC GARDENS, KEW, SURREY, 16 May. Mr H. J. Bruty BEM conducted a tour of the ferneries, including the new filmy-fern house.

BROCKENHURST and **LYNDHURST,** HAMPSHIRE, 19-21 June. As in 1963, noteworthy ferns among 18 species seen were *Ophioglossum*, *Osmunda* and *Pilularia*. In addition we found *Ceterach officinarum* and *Polystichum setiferum*.

AUSTWICK area, MID-WEST YORKSHIRE, 4 & 5 July. Together with other lime-loving species, several plants of *Polystichum lonchitis* were seen during this Northern weekend meeting.

CHELSEA PHYSIC GARDEN, LONDON SW3, 25 July. The Curator, Mr W. G. Mackenzie, showed and explained the treasures of the Garden after telling us its history from 1673. Among the collection of British fern species in the conservatory, it was good to see our three filmy-ferns thriving in a Wardian chamber among other ferns and liverworts, and also some fern varieties remaining from the days of Thomas Moore's curatorship 1848-1887. In one of the glasshouses, part of the plant of *Asplenium* × *murbeckii* collected by F. Jackson in Borrowdale (GAZETTE **9**:49,110) was still flourishing. Professor J. Ewan and his wife, of Tulane University, were with us; we were charmed to have them and to strengthen the link between ourselves and the American Fern Society of which he is a past-president.

TUNBRIDGE WELLS area, KENT, 23 August. After assembling at Eridge Railway Station several localities were visited, including Eridge Green and Saxonbury Hill, as we worked our way across country to Frant. Many species were recorded, including *Hymenophyllum tunbrigense* and *Dryopteris aemula*. It was a great pleasure to have with us two members of the American Fern Society, Dr R. M. Tryon and his wife Dr A. F. Tryon, of the Gray Herbarium.

THE ANNUAL EXCURSION, 12-19 September. Thirty-two members (including Dr Patzak from Vienna) and three friends attended at Brantwood, on the east side of Coniston Water in the Lake District. Formerly the home of John Ruskin, Brantwood is now the conference and study centre of the Council for Nature.

We gathered on the Saturday in lovely weather, looking forward to a happy week among the Lakeland ferns. It gave us great pleasure to see many new faces and to welcome new members. The afternoon was occupied with fern-hunting in the vicinity of the house, and in the evening we assembled

in the lecture-room (Ruskin's former study) to hear an illustrated talk by the Warden, Mr Jeeves, on ecology in the Lake District.

Our Meetings Secretary, Squadron-Leader Halligey, had prepared a very full and active programme which kept us on the move all the week. The only fault was that it covered so much ground that we had little time to devote to our immediate neighbourhood, and this will have to be remedied during our next visit. We *shall* be going there again, for the area is an excellent one for ferns, and Brantwood makes an ideal centre—and a comfortable one, especially in wet weather. We can vouch for this because, after a fine weekend, the rain began on Monday and continued all the week. On only one day, however, did it upset our programme, and on this day we made good use of the time with talks in the lecture-room.

On the morning of Sunday we decided to follow the nature-trail laid out in the Brantwood grounds which cover 250 acres. We started off conscientiously following the trail until we reached a ravine cutting deep into the hillside, a veritable fern paradise, and—the fern hunt was on, the nature trail forgotten! *Polystichum aculeatum* and *P. setiferum* flourished, *Hymenophyllum wilsonii* was noted several times, *Gymnocarpium dryopteris* and *Thelypteris phegopteris* grew luxuriantly, and *Polypodium*, *Athyrium* and *Dryopteris* draped the steep banks and precipitous rocks. Altogether, within the confines of the estate and within a small radius of the house we recorded 21 fern species, and in the lake below the house *Isoetes lacustris* was found.

The attraction of Coniston Old Man across the Water could not be ignored, and one of our first visits was planned for this area, as it offered us a variety of habitats from the lakeside up to the high crags; bad weather postponed it for two days. Starting off from Coniston, we recorded 16 species on the way up from the village, including *Osmunda regalis*. On the fell itself we added only *Asplenium adiantum-nigrum*, *Lycopodium clavatum* and *L. selago* to the list.

A visit to Whitbarrow Scar made another memorable day—both for finds and for rain! Leaving the cars at Witherslack Hall we followed a woodland track to the base of the Scar, noting on the farm walls *Asplenium ruta-muraria*, *A. trichomanes*, *Ceterach officinarum*, *Phyllitis scolopendrium* and *Polypodium vulgare*, while in the woods *Dryopteris carthusiana*, *Polystichum aculeatum* and *Thelypteris phegopteris* were seen. In the limestone pavement and lines of low cliff on top of the Scar we found 18 ferns, including *Asplenium viride*, *C. officinarum*, *Cystopteris fragilis*, *Dryopteris villarii*, *P. scolopendrium* and *Gymnocarpium robertianum*. In scrubby growth appeared also *Athyrium filix-femina*, *Dryopteris borreri*, *D. filix-mas*, *D. dilatata*, *Polystichum aculeatum*, *Thelypteris limbosperma* and, rather surprisingly, *Dryopteris carthusiana* and *Blechnum spicant*. It was interesting to note the lime-hating *B. spicant* growing here, indicating the presence of pockets from which the lime had been leached.

The woodland area to the south of Coniston Water provided an inter-

lude on a day when the rain stopped for only a few hours. We listened to a most interesting lecture by Dr Holttum on the ferns of the world (see pages 00-00) in the morning while the rain poured down, and returned about four o'clock when it recommenced to hear Mr Kaye give his presidential talk on variations of the Ladyfern (see pages 197-204). We noted 16 species during the day, including a fine colony of *Ceterach officinarum*.

A day was spent renewing our acquaintance with Borrowdale where the Annual Excursion was centred in 1954. It was a hurried visit and we concentrated our attention on Castle Crag where we found *Asplenium septentrionale*. *Dryopteris abbreviata* was growing in crevices on the top of the cliff and exhibiting its best characters; we were able to name them with confidence, something we are often diffident about doing, because stunted plants of *D. filix-mas* and *D. borreri* growing in rock and mountain habitats can be very misleading. *Gymnocarpium dryopteris* and *C. fragilis* were seen on the Crag, *H. wilsonii* in the woods at the bottom, and in the damper places *T. phegopteris* was abundant. We also noted two polypodies, *P. interjectum* and *P. vulgare*. In all, 18 species were recorded from this small area. Some of us went on to see Mr Fred Jackson's garden and fern collection at Stonethwaite, and it was a joy to see so many of our more interesting ferns so well grown.

Humphrey Head is an interesting limestone spur jutting out from the coast a few miles south of Grange-over-Sands, and supports a flora which includes some rarities. Our visit was a short one so we were able to explore only a small part of the Head, and not many species were seen. The varietal find of the week was made here, a colony of *Polypodium australe* 'Semilacerum'. On our way to Humphrey Head we visited the Nature Reserve at Roudsea Wood where we were welcomed by the Warden who conducted us round this large tract of woodland and heath. Many unusual plants were seen, including a rare sedge *Carex flava*, which is one of the reasons for the protection given to this locality. Ferns were prolific and we recorded 17 species, including *Ophioglossum vulgatum* and *Osmunda regalis*. Our day in the Grange-over-Sands district culminated in a visit to our member Miss Tetley, who most hospitably provided tea in one of the local hotels in Cartmel before we visited her fernery. Her most interesting collection of British and foreign ferns is in a greenhouse and a conservatory and in the garden borders; in her house she had laid out an exhibition of fern books and herbarium specimens. We carried away with us gifts of plants as well as memories of a very happy visit to this generous lady.

On the following day we set off on our homeward journeys but, before our ways divided, we again received a gracious hospitality—this time from our President and Mrs Kaye who invited us to their house and nurseries in the morning before entertaining us to lunch at a Silverdale hotel. It is worthy of note that in the nurseries we were able to see one of the best varietal finds made during the Society's excursions in recent years, *Asplenium trichomanes*

'Incisum Greenfield', a wild find by P. Greenfield in the Quantock Hills in Somerset in 1960, and without doubt the finest incised form of this species yet found. The plant was successfully established in Mr Greenfield's garden in Surrey, but he felt it would be more likely to survive in Mr Kaye's care and so it was sent to Silverdale about two years ago. It was evident from the fine development and vigorous condition of the lovely plant we were able to admire that the decision to send it North was a wise one.

Some good fern varieties were found this year, the best being *Polypodium australe* 'Semilacerum' collected from Humphrey Head. Crested ladyferns were found on Whitbarrow, and more were seen along the roadside near Brantwood as well as crested forms of *Dryopteris borreri*. On a wall in Keswick we were introduced to a colony of *Asplenium trichomanes* 'Cristatum', the numerous plants being a very fine form of this variety. Other variations of a minor nature were noted, including a crenate form of *Ceterach officinarum*.

Among the pteridophytes seen during the week, 13 were new records and 4 were confirmations of pre-1930 records for 10-kilometre squares (we visited seven) of the ATLAS OF THE BRITISH FLORA. A survey of polypodies segregated 154 specimens into 116 *Polypodium vulgare*, 29 *P. interjectum*, 4 *P. australe* and 5 pentaploid hybrids. These records, together with 34 segregates within the malefern complex (17 *Dryopteris filix-mas*, 15 *D. borreri*, 2 *D. abbreviata*), have been passed to the Nature Conservancy for inclusion in the ATLAS and its forthcoming critical supplement.

In the following list of pteridophytes seen during the excursion, figures 1-24 (**bold** =new record, * =confirmation of pre-1930 record, for the ATLAS) refer to localities:

Asplenium adiantum-nigrum — *2, 7, 10, 24*
A. ruta-muraria — *2, 4, 5, 7, 10, 12, 13, 14, 15, 17, 24*
A. septentrionale — *24*
A. trichomanes — *2, 3, 4, 5, 7, 10, 12, 13, 14, 15, 17, 24*
A. viride — *14*
Athyrium filix-femina — *1, 2, 3, 4, 5, 7, 12, 13, 14, 16, 18, 19, 20, 22, 23, 24*
Blechnum spicant — *1, 2, 3, 4, 5, 6, 9, 13, 14, 16, 20, 23, 24*
Ceterach officinarum — *2, 14*, 15*, 17*
Cryptogramma crispa — *2, 3, 5, 6, 7, 9, 17, 20, 22, 23, 24*
Cystopteris fragilis — *2,* **14,** *24*
Dryopteris abbreviata — **2,** *24*
D. borreri — *1, 2,* **3,** *4, 5, 7, 9, 13, 14, 16,* **19, 20,** *22, 23, 24*
D. carthusiana — *1, 13, 14*, 16*, 19*
D. dilatata — *2, 3, 4, 5, 7, 9, 12, 13, 14, 16, 18, 19, 20, 22, 23, 24*
D. filix-mas — *1, 2, 3, 4, 5, 10, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24*
D. villarii — *14*
Equisetum arvense — *5, 13, 17*
E. telmateia — **21**
Gymnocarpium dryopteris — *2, 3, 24*
G. robertianum — *14*
Hymenophyllum wilsonii — *2, 23*
Isoetes lacustris — **2, 11**
Lycopodium clavatum — *7*
L. selago — *7*

Ophioglossum vulgatum — *13*
Osmunda regalis — *8*, *13*
Phyllitis scolopendrium — *2*, *10*, *13*, *14*, *15*, *17*
Polypodium australe — *10*
P. interjectum — *4*, *5*, *6*, *7*, *9*, *15*, *17*, *18*, *20*, *22*, *23*, *24*
P. vulgare — *1*, *2*, *3*, *4*, *5*, *6*, *7*, *9*, *12*, *13*, *14*, *15*, *17*, *18*, *20*, *22*, *23*, *24*
P. interjectum × vulgare — *3*, *17*, *18*, *20*
Polystichum aculeatum — *2*, *10*, *13*, *14*, *16*
P. setiferum — *2*, *10*
Pteridium aquilinum — *1*, *2*, *3*, *4*, *5*, *6*, *7*, *9*, *13*, *14*, *15*, *16*, *17*, *18*, *19*, *20*, *22*, *23*, *24*
Thelypteris limbosperma — *2*, **3**, *4*, *5*, *7*, *9*, *13*, **14**, **16**, **20**, *23*, *24*
T. phegopteris — *2*, **3**, *5*, *9*, *13*, *16*, *22*, *23*, *24*

	V.C. 69 Westmorland (with North Lancaster) (*O.S. 1″ map ser. 7 sheets* 88 *and* 89)	Date visited September	National Grid Ref.
1	ANNA'S WOOD	15	34/2991
2	BRANTWOOD	12–19	3195, 3196
3	BURNEY	15	2586
4	CONISTON Village	12–17	3097
5	CONISTON, near Railway Station	16	2997
6	CONISTON, road above Railway Station ...	16	2997
7	CONISTON, moor track leading to Church Beck	16	2798, 2898
8	CONISTON, Church Beck	16–17	2998
9	CONISTON OLD MAN, cliffs near Low Water ...	16	2798
10	HUMPHREY HEAD	18	3973, 3974
11	LAKE WINDERMERE	14	3995
12	LOWICK BRIDGE	15	2986
13	ROUDSEA WOOD, Nature Reserve	18	3281, 3282, 3381, 3382
14	WHITBARROW SCAR	14	4485, 4486, 4487
15	WITHERSLACK HALL farm walls	14	4385, 4386
16	WITHERSLACK HALL woods	14	4386
17	WOODLAND Church vicinity	15	2489
18	WOODLAND Church to Row Ridding, roadside ...	15	2489
19	WOODLAND vicinity, Row Ridding, woods ...	15	2489
20	WOODLAND vicinity, hillside above Raisthwaite	15	2589
21	WRAYSHOLME TOWER, ditchbank by road ...	18	3875
	V.C. 70 Cumberland (*O.S. 1″ map ser. 7 sheet* 82)		
22	BORROWDALE, between Grange and Hollows Farm	17	**35**/2417
23	BORROWDALE, between Hollows Farm and Castle Crag	17	2416, 2516
24	BORROWDALE, Castle Crag	17	2415, 2416, 2515, 2516

ANNUAL GENERAL MEETING, 16 September. Held during the Annual Excursion. Reported in NEWSLETTER 2, January 1965.
BRITISH MUSEUM (NATURAL HISTORY), LONDON SW7, 24 October. Mr J. A. Crabbe conducted a visit to the Herbarium and Library of the Department of Botany, followed by a conversazione and exhibits.

Amendment to account of 1963 Annual Excursion

On page 191 of the 1964 GAZETTE the vice-county numbers on lines 16 and 18 should be transposed, i.e. locality 33 should be V.C.47 and locality 34 should be V.C.46.

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PSILOTUM NUDUM IN EUROPE

BETTY MOLESWORTH ALLEN

Villa Coca, Los Barrios, Prov. Cadiz, Spain

In January 1965 I found near Algeciras in southern Spain a colony of *Psilotum nudum* (L.) Griseb. growing in a rock crevice. This is one of the primitive fern-allies, belonging to the PSILOTOPSIDA and has not hitherto been recorded for Europe. This class comprises two genera: *Tmesipteris* confined to the southern hemisphere and *Psilotum* which occurs in most tropical countries reaching Japan in the north and southern Africa, Australia and New Zealand in the south; the closest locality to Europe seeming to be the Cape Verde Islands.

The area where I found the *Psilotum* lies approximately 20 kilometres from Algeciras at about 170m above sea-level where large outcrops, probably sandstone, occur amongst the cork woods. The first plants found were growing in an almost horizontal deep and very narrow fissure, about one metre up the vertical face of a 30-metre outcrop facing south. There was one clump, then a space of 17 cm, then some small plants were spaced for a distance of 12 cm, and some dead fronds extended for a further 11 cm. No other plants were mixed with the *Psilotum*, but in more sheltered crevices on the almost bare rock were a *Ruscus* (probably *R. hypophyllum*) and a small plant of *Asplenium adiantum-nigrum;* about one metre above was a large prostrate plant of *Calluna vulgaris* from whose humus-packed base grew a *Davallia canariensis*. Above these on a small shelf were quite tall plants of *Erica scoparia* and more *Calluna*. Growing at the outcrop base was *Rhododendron baeticum* which gave slight shade to the *Psilotum* from the west at least, *Rubus ulmifolius*, and a *Smilax*, all of which were common. Against the rock was one *Digitalis purpurea* and a few small plants of a *Galium* together with some grasses. The stream lay about 6m away from the rock base which was shaded by tall oleanders and a very large alder. On the opposite side the ground sloped upwards and was covered nearer the stream by an oak (*Quercus lusitanica* var.?) and then by cork oaks (*Q. suber*); heaths and *Cistus* spp. covered the ground beneath.

Later I found more *Psilotum* growing 20m higher up the same vertical rock face, but about 2m above a shelf. There were five distinct and quite separate patches, all round about the same level and all in narrow fissures which with two exceptions were nearly horizontal. The plants were in full sun, at least in summer, but usually a slight projection of the rock gave a little shelter from the west. The largest patch was about 75 cm long and the plants were short and thick and often bunched together. About 20 cm away, but in the same fissure, was a single *Ruscus* but nothing else, the rock itself being bare except for many lichens, a liverwort, and a small *Sedum* which occurs in earth pockets; no doubt other plants would also be there during the wet months. The

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shelf immediately below had sparse vegetation on a thin layer of soil: one plant of *Erica scoparia*, one of *E. australis*, a large patch of the stemless palm *Chamaerops humilis*, and a small cork oak which gave a little shade to some of the *Psilotum*. The *Sedum* was common here.

The heat of this rock during the summer months is intense, for the sun shines on it all day, but the deep narrow fissures in which the *Psilotum* grows would probably remain rather cool. The stream apparently dries up at this point in August/September.

Perhaps worth noting is that a few metres away to the west of the face is a large and similar cliff, also with horizontal fissures; but it faces due east and there was no *Psilotum* on it, and with one exception its vegetation consisted of plants not noted on the former rock; these included *Cistus ladaniferus, Arbutus unedo*, a *Ulex* and a *Cytisus;* the only plant common to both places was *Erica scoparia*.

Approximately 400m downstream of the *Psilotum*-bearing rock and beyond a definite curve in the stream were three more patches of *Psilotum*. These were near the base of a vertical face of a very large rock outcrop, similar to the former except that the altitude was about 130m and the face received more permanent shade from tall *Quercus* spp. which were closer to the rock face and in the winter would probably be very damp. Two patches stretched for about 2m along a horizontal crevice; the other was a smaller and denser tuft.

Whilst it must not be overlooked that *Psilotum* escapes easily from cultivation, this Spanish locality seems sufficiently remote and the habitat relatively undisturbed to consider this species native. It may therefore be found in similar areas here in the south, and it is still possible that further specimens from Spain may turn up in herbaria.

I am most grateful to the Director and Dr Frances Jarrett, Royal Botanic Gardens, Kew, for assistance. Herbarium specimens have been deposited at Kew and the British Museum (Natural History), London: B. E. G. Molesworth Allen 5082 (K), 5088 (BM).

REVIEW

NATURE IN NEW ZEALAND series : NATIVE FERNS by Bruce Hamlin; 64 pages, 13 × 19 cm; Wellington: Reed, 1963; price 8 shillings.

The most striking feature of this little book is the 25 pages of line drawings illustrating the 107 species of ferns described; the thumbnail sketches of the tree ferns are particularly fine and expressive. The text gives the local name, Latin name (with translation) and a short description of the plant and its distribution in New Zealand. The species are arranged in genera or generic groups, but for the uninitiated a key would have been useful. In all, this is a neat inexpensive book that is well worth the money.

British Museum (Natural History), London SW7 A. C. JERMY

Psilotum nudum in a rock crevice near Algeciras, southern Spain. Photo: F. G. H. Allen

FERNS IN A WARDIAN CASE

GEOFFREY GILBERT

116 Haverstock Hill, London NW3

About two years ago I decided to build a wardian case, chiefly for the purpose of growing ferns. Such a case not only allows for the growth of many specimens in a small area, but also permits a high degree of control, so that exact observations can be made. The idea was not new to me, for I could remember being inspired and delighted by a wardian case owned by my grandmother, when I was a child. This case was built outside the window, so that when you opened the sash you looked into a moist, ferny world that contained a miniature pool and an orchid that actually flowered, albeit somewhat erratically. The pleasure this case gave to its owner in later years illustrated the value of an idea developed by Dr Ward more than a century ago, but now largely neglected.

The actual construction of my case, which stands in a sheltered corner on the north side of my house, may be judged from FIGURE 1. It is six feet long and three deep, at present providing for 82 specimens with space for more. The base is formed of corrugated asbestos sheet, covered with broken brick and a layer of peat five inches thick. It stands at table level and opens at both front and top to allow convenient access. Some form of small lattice window, though not yet installed, is urgently needed to allow access in cold weather without unreasonable chilling.

HUMIDITY

The plan of the case was based on a series of observations, rather than precedent. Important among these was the fact, familiar to everyone, that if a patch of damp, shady ground is covered with a bell jar, an abundance of ferns, liverworts and mosses, quickly springs up. I associated this fertility with the moisture content of the air, a hair hygrometer showing that this was seldom far short of 100%. As will be seen later, this was not the whole story, but fortunately my omission did not involve alteration of the structure.

HEATING

To obtain high humidity without heating is usually a simple matter of stopping up cracks and providing a large evaporating surface, for which the peat was likely to suffice. I wished however, to use higher temperatures. As is well known, when a hot body is placed in an enclosed space, the humidity is reduced out of reasonable proportion to the increase in temperature. In my case an electric light bulb will often reduce humidity 20% without noticeable effect on the temperature.

In a conventional greenhouse this drawback is overcome by laborious spraying whenever the pipes have to be particularly hot. Such a course is out of the question in a case sited out of doors, where this would involve deluging the plants with cold air as well as water.

To avoid this difficulty, I decided to use a warm pool as a source of heat. Water heating on this scale can conveniently be provided by a standard 200w aquarium heater with thermostat. I use a three-gallon tank kept at 90° in winter and this gives a temperature of about 40° in cold weather. A paraffin heater can be used under the peat bed, to help out in very severe conditions. The tank steams freely into the air, too freely without control, which is easily provided by means of metal shutters to cover part of the surface. Only a small area is normally exposed and the metal shutters provide a convenient site for raising spores, which do best at a temperature of 75° or thereabouts. The tank is surrounded by a miniature rock garden suitable for growing mosses, lycopodiums, etc.

It might be supposed that such a high humidity level, usually 100%, would prevent evaporation and harm the plants, but in practice air moves continually, apparently picking up moisture in one place and depositing it in another, so that evaporation never really ceases. Indeed the 100% figure may be no more than a sort of microclimate in the instrument itself, while considerable variations exist in the air currents.

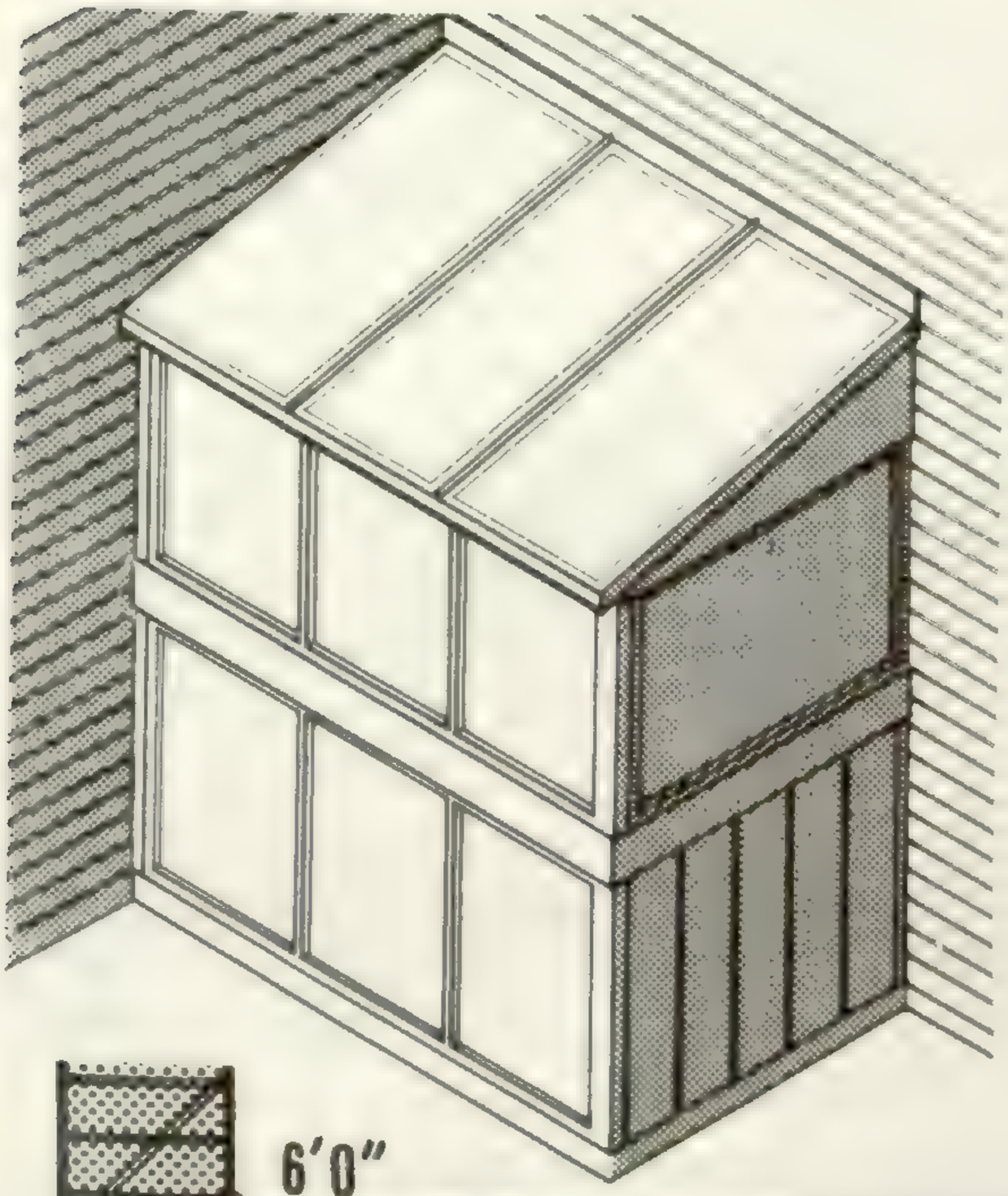
One advantage of humidity relates to root aeration. Some ferns such as the parsley fern, are very sensitive in this respect and only grow satisfactorily when their roots are spread out among stones and moist air circulates freely. Actually air in relation to root growth is mentioned in every book, but in my experience, more often mentioned than put into practice, chiefly for the obvious reason that air dries out the soil with irritating rapidity. Since this drawback does not appear in a humid fern case, composts can be very open, with a large amount of broken brick, pot, etc. if desired. The pots should be raised, so that air can flow freely through the hole in the bottom. The parsley fern and other plants with the same requirement will then behave perfectly well.

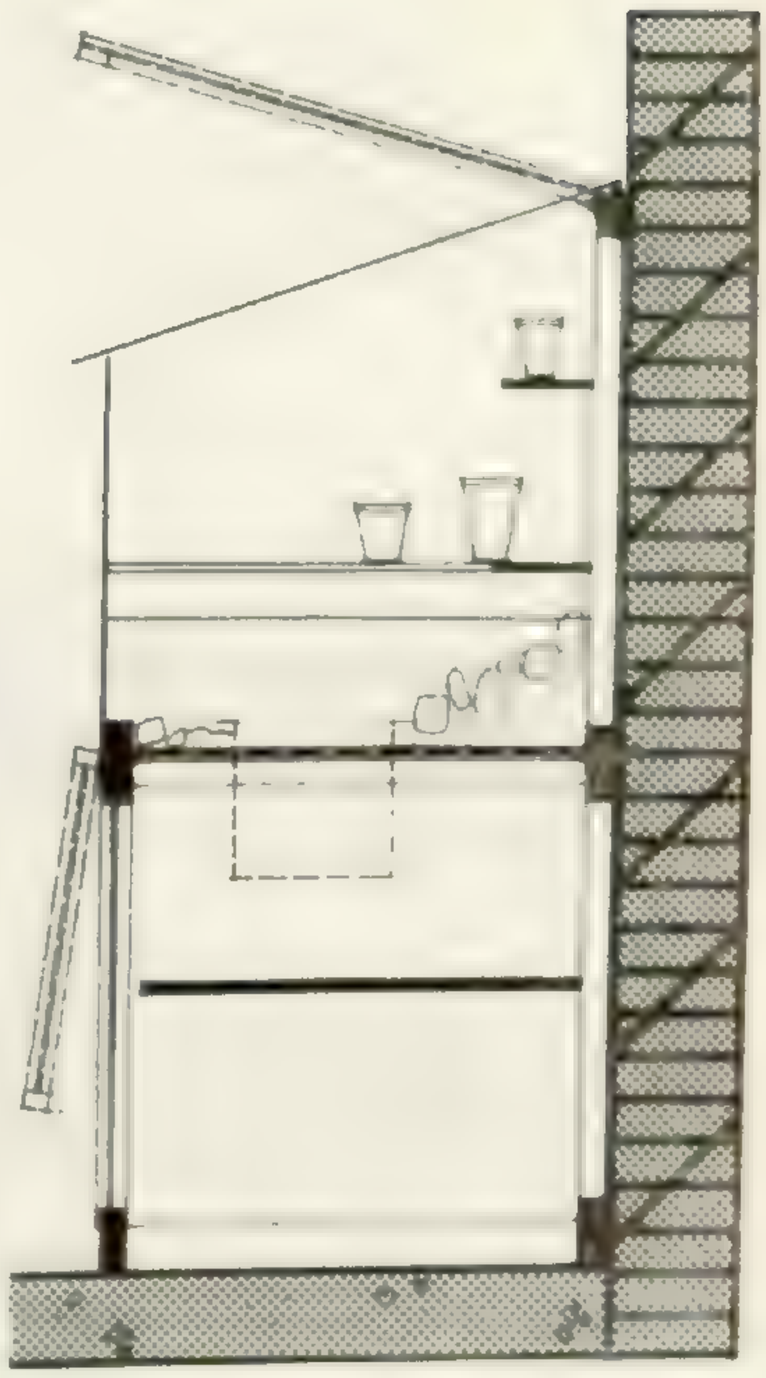
THE CO_2 COMPLICATION

When the case was beginning to grow in a satisfactory way, I repeated the bell-jar experiment, first clearing an area of peat, that I

FIGURE 1 Geoffrey Gilbert's wardian case

A) active compost to supply additional carbon dioxide, B) soil or peat for ferns, C) cover sheet to control moisture, D) aquarium heater with thermostat, E) perforated zinc sheet covered with gravel, F) corrugated asbestos sheet.





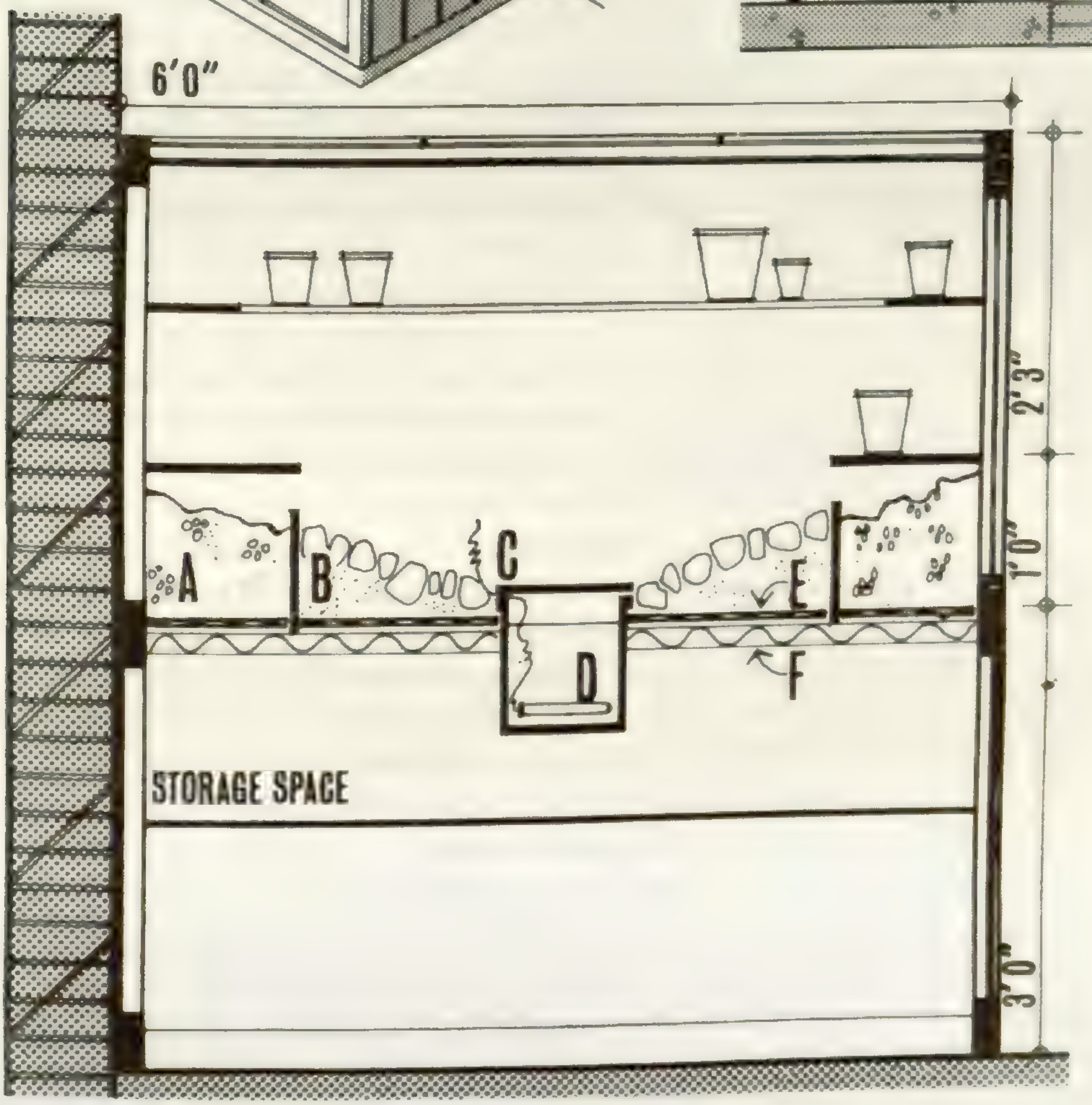


FIGURE 1

judged well supplied with spores. Part of the surface was covered and part kept as a control area. I confidently expected that both would now yield the same result, but I was completely wrong. The area under the jar was choked with young growth before the area outside even began to grow.

After some experiments I obtained one of the indicator solutions used when it is intended to increase the CO_2 content in commercial greenhouses. Since soil is credited with producing as much as an ounce of carbon dioxide per square yard per day, it was not surprising to find a high concentration under the jar, probably sufficient to be toxic to some plants. In deficit of other explanation it seems reasonable to associate this concentration with the rapid development of spores of mosses, liverworts and ferns and the attractive liveliness of young growth. It may perhaps be pointed out that the concentration under a jar soon diminishes as the plant increases in size and eventually becomes sub-optimal. In my experience, plants then weaken, lose colour and are usually attacked by fungi, a point to watch in bottle gardens.

The CO_2 concentration in my case, though showing more diurnal variation, was approximately equal to that outside and it seemed likely that a greater concentration would be an improvement. An easy way of producing clean CO_2 is by means of rotting vegetable matter so, clearing a space under a shelf, I added a large pile of peat soaked in suitable fertilizer. There was little room for doubt about the effect of this measure, mosses and young ferns springing up in abundance and a general liveliness to be noted in the vegetation. This improvement however, still fell short of the effect produced by the bell-jar and it would be interesting to experiment with an artificial source of carbon dioxide.

It would be useful to know if anyone has knowledge of the effect of carbon dioxide on spores and prothalli, as it is these that appear to be so noticeably affected. Traditionally they do best on soil that has been lightly scalded, not sterilised, and covered with a glass. My first sowing on elaborately sterilised soil, protected in every way, took seven months to germinate. Can this have been connected with the lack of any living things to produce CO_2? The small amount of air under the glass at the top of a pot is certainly heavily impregnated.

THE LIGHT FACTOR

Another point that must be thought about carefully before siting the case is the light factor, as it is obviously annoying, especially from a decorative point of view, to have to paint the glass and worse to get inadequate growth. To make certain on this point, I established a number of ferns under glass covers and placed them in various situations. Measurements of frond lengths were used as a rough indication of growth and an ordinary exposure meter used to measure light values.

This involved some trouble, perhaps out of proportion to the immediate need, but of sufficient general interest to appear worthwhile.

Summarising the results briefly, I found that no fern seems to benefit by an open situation, usually the reverse, and that they vary greatly in relation to their minimum requirements. Some will grow well, developing large handsome fronds when the light is no stronger than 1 foot-candle, as against 400 in sunlight. Others, particularly the large ferns such as *Dryopteris borreri*, develop very slowly below 25 foot-candles. By far the most adaptable fern I tried was *Asplenium trichomanes*.

Temperature and the CO_2 factor obviously confuse these results but they may be taken as sufficient for the purpose. The conclusion seems to be that a noon reading of twenty-five foot-candles is the best compromise. This condition prevails in a well lit room near to the window and I was able to arrange the same light value in a convenient corner on the north side of the house.

APPEARANCE OF THE CASE

The charm of a wardian case lies in the richness of the vegetation and the perfection of the green shades that respond so well to moist conditions. Here ferns may reveal a beauty not seen in nature. Mosses add greatly to this effect and can advantageously cover every stone or area of soil.

On the practical side it should perhaps be mentioned that mosses, in colonising stones, are usually handicapped by lack of nitrogen. For instance a brick soaked in ammonium sulphate will cover with moss in a matter of weeks, where years may be required without fertiliser. The traditional and safer method fertilising is to paint with whey from sour milk. Choise mosses such as *Thuidium* or *Leucobryum* should be watered with rain water and of course must be introduced.

Flowering plants may be introduced for variety. Orchids and epiphyllums are very suitable and many small woodland plants such as *Soldanella, Pyrola, Shortia, Trientalis* are worth trying, remembering that those coming from pine-woods may need an occasional dressing of needles to maintain the acidity. Of course fern prothalli spring up everywhere and one always hopes to find interesting hybrids.

The introduction of mosses and other irrelevant specimens to build up an effect may strike the more serious pteridologist as just time-wasting beautification. I can point out however, that there is much of scientific interest in a small area of mixed vegetation. In such a convenient place you are likely to look far more closely and observe details that might escape you in a woodland area. You never quite know what you will find when you open your case in the morning. It is interesting even to find that something has died, though I myself, lacking true scientific detachment, prefer the reverse to happen.

THE IDENTIFICATION OF BRITISH *HYMENOPHYLLUM* SPECIES

GARETH B. EVANS

University of Malaya, Kuala Lumpur.

The confusion which has surrounded the identity of *Hymenophyllum tunbrigense* (L.) Smith and *H. wilsonii* Hook. since the time of John Ray has already been reported (EVANS & JERMY 1962). An account of the biology of the two species will shortly be published in the Biological Flora of the British Isles series in the *Journal of Ecology*. This present paper describes those features of their morphology and anatomy which can be used to distinguish them both in the field and herbarium.

The sporophytes of both species form moss-like carpets with numerous overlapping and often pendulous fronds borne on the densely interwoven thread-like rhizomes. The fronds are superficially alike, as can be seen from the silhouettes in FIGURES 1–13. The stipe is thin and glabrous, about half the length of the rhachis, and the frond lamina whilst very variable in size is nearly always longer than broad. It bears numerous short pinnae around 1 cm long arranged alternately on the rhachis. The pinnae are divided dichotomously into several segments, each segment 3–5 mm long and 1 mm wide. The sori are found terminally on the segment nearest the rhachis, but occasionally two to several may occur on one pinna.

In both species the translucent lamina is only one cell thick except immediately around the nerve, yet the species differ in colour and texture, especially in older mature fronds. *H. wilsonii* is a darker olive green with a reflecting surface whilst *H. tunbrigense* has a lighter blue green hue with a matt surface. Moreover, the lamina in *H. wilsonii* has a less membranous texture and also its stipe and rhachis are stiffer than in *H. tunbrigense*. Stunted fronds in exposed colonies of *H. wilsonii* are held almost vertically whereas those of *H. tunbrigense* usually have a sharp bend in the stipe so that the fronds lie nearly horizontal to the rhizome mat. They differ as well in the angle of attachment of the pinnae to the rhachis; each pinna axis in *H. tunbrigense* grows approximately at right angles to the rhachis and the pinnae segments point forward and are so held that the overall frond surface is flat or slightly convex. In *H. wilsonii,* on the other hand, the axes of the pinnae depart nearly at right angles from the rhachis but are deflexed and as the segments are not aligned along the plane of the lamina the frond appears in profile to be a one-sided series of tiers. It was for this reason that the species was formerly called *H. unilaterale*.

In addition there are fewer segments per pinna in *H. wilsonii* (rarely exceeding 3–5) and they are displayed almost palmately because the

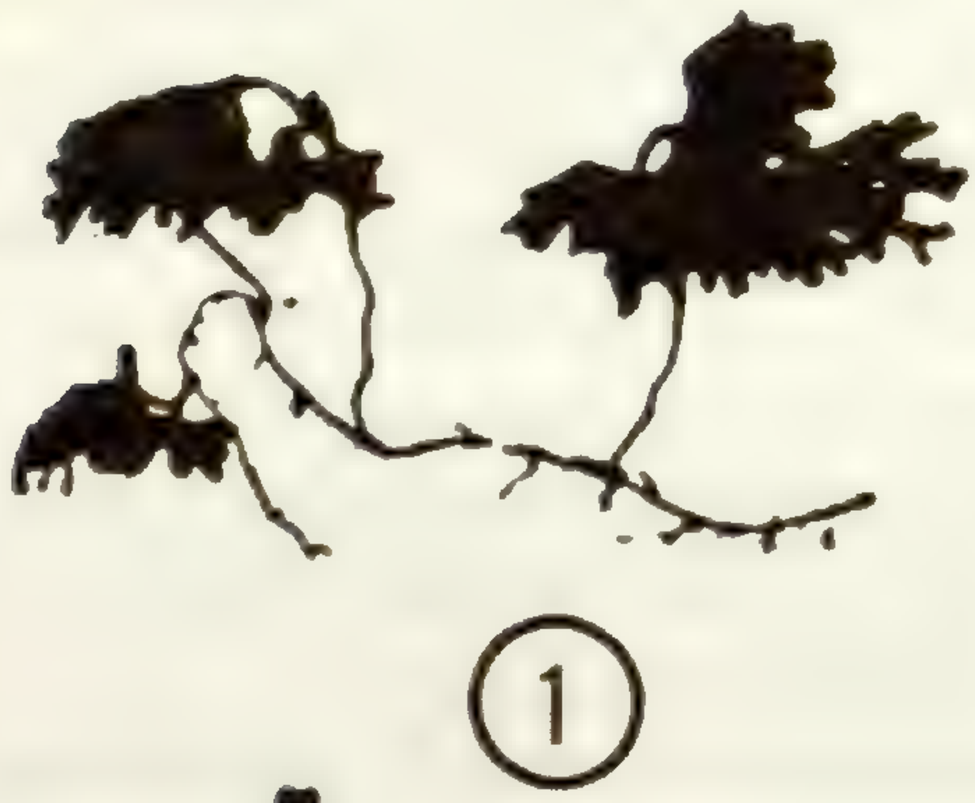
points of dichotomy lie close together. In *H. tunbrigense* there are more segments per pinna, usually between 5–11, and they lie predominantly on the acroscopic side, i.e. that side of the pinna nearest the apex. The pinna segments have nearly parallel sides in *H. tunbrigense* and the lamina is continuous from one segment to the next. In *H. wilsonii* the segments are ovate-lanceolate and taper to their base, remaining scarcely connected to each other by any lamina. Successive pinnae in *H. wilsonii* are almost the same size and length, but in *H. tunbrigense* they rapidly shorten so that the frond shape is broadly ovate-lanceolate contrasting with narrowly lanceolate in *H. wilsonii*.

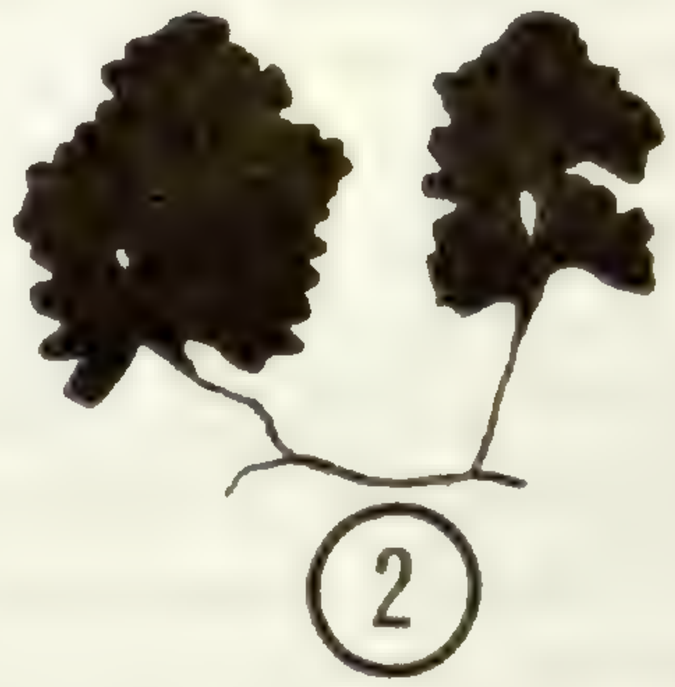
The combination of these features of shape, orientation, colour and texture enables one with a little experience to distinguish by eye most colonies at distances up to twenty feet! In well pressed herbarium specimens most of these features are lost, but the relative number and shape of the segments can still be used to separate them on most occasions, although other criteria must be used for confirmation.

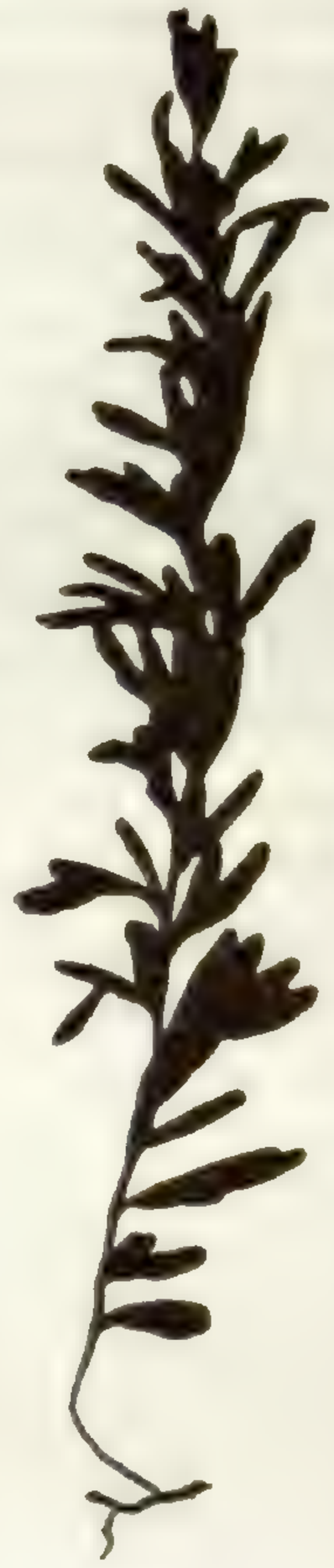
When sori are present the species can be very easily distinguished. In both, the sorus consists of two green indusial flaps (or valves) which freely articulate at the base enclosing a cluster of sporangia arranged compactly on a central column. *H. wilsonii* generally bears more, around 10–15, sori per frond than *H. tunbrigense* which has around 5–10. They are pear-shaped and swollen in *H. wilsonii* resembling a duck's bill and invariably project perpendicularly to the plane of the lamina. In *H. tunbrigense* they are sub-orbicular and only slightly swollen, lying almost in the plane of the lamina. The indusial valves gape widely at maturity in *H. wilsonii* but this is less conspicuous in *H. tunbrigense*.

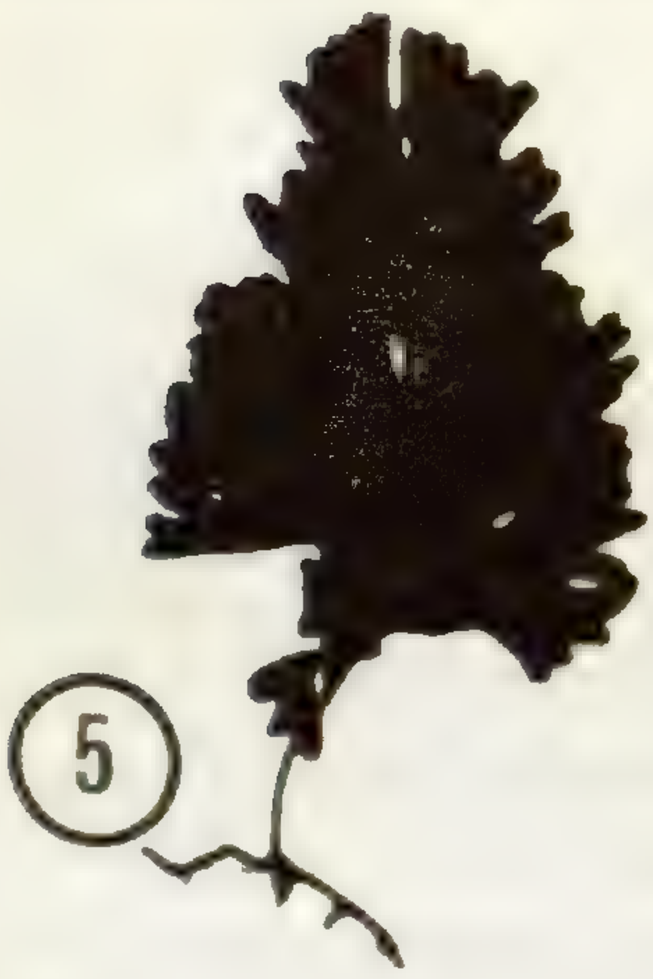
However, the most reliable and convenient criterion of all for identifying fertile material concerns the indusial valves. In *H. wilsonii* the edges are quite entire, whereas in *H. tunbrigense* the distal edges are raggedly toothed. This character was first noticed by William Wilson and taken up by W. J. HOOKER (1830) in the first validly published description. During my examination of hundreds of specimens I found no reason to doubt the reliability of this character.

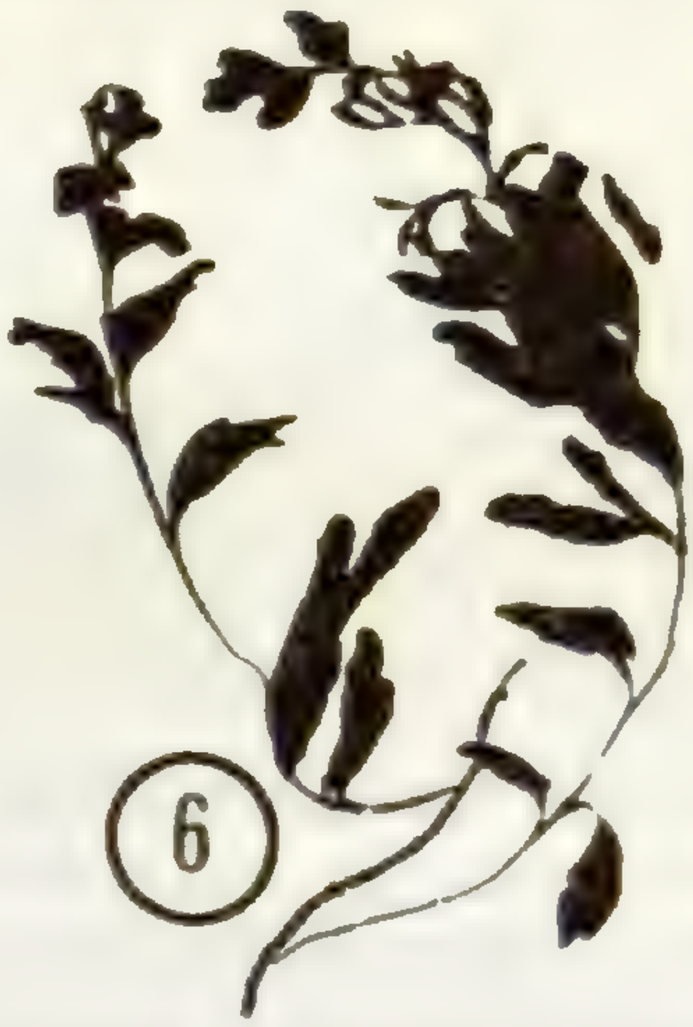
The anatomy of the fronds provides additional distinctions. One that is occasionally quoted, e.g. HYDE and WADE 1962, refers to the distal point of the pinna segment; the vein is said to end before the tip in *H. wilsonii*, i.e. c.4 cells behind, but continue to the tip, i.e. c.2 cells behind, in *H. tunbrigense*. Unfortunately, I have observed that this distance is dependent on the growth phase of the segment, the vein appearing nearer the tip in young vigorously expanding segments of *H. wilsonii* and in my experience, whilst it holds true in many cases, it is not a reliable character.











FIGURES 1–7 *Hymenophyllum* (T = *tunbrigense*, W = *wilsonii*) from average conditions

1) desiccation-resistant phenotype of T from exposed rockface; 2) T from crevice within boulder scree; 3) T as 2 but darker and wetter; 4) T deep within narrow crevice in sandstone outcrop (Sussex); 5) T beneath rock overhang at cliff-base (Sussex); 6) W from carpet within boulder scree; 7) W as 3. ALL NATURAL SIZE.

FIGURES 8–13 *Hymenophyllum* (T = *tunbrigense*, W = *wilsonii*) from very lush conditions

8) laboratory culture of T with low light and above 90% humidity; 9) frond of T from Killarney; 10) three-year-old frond of T cultured in high light, humidity and temperature, cf. Fig. 13; 11) W as 8; 12) W as 9; 13) exceptional specimen of W from Fermanagh (coll. Praeger 1904, hb.Nat.Mus.Dublin). ALL NATURAL SIZE EXCEPT FIG. 13 HALF SIZE.

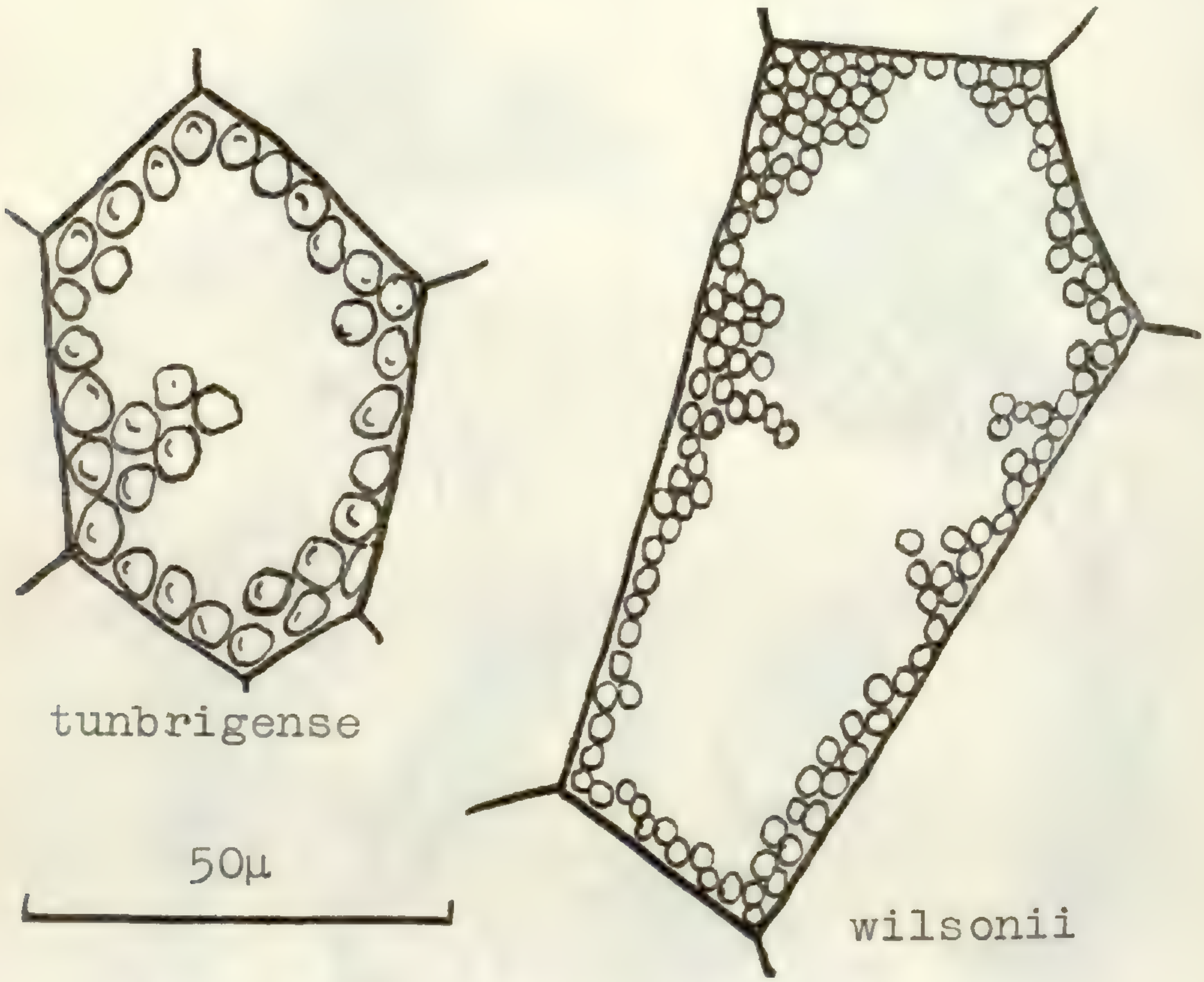


FIGURE 14 Frond cells of *Hymenophyllum*

Differences in the surface appearance of the lamina are also apparent; in the words of W. J. Hooker (Brit.Fl.: 450. 1830) "[wilsonii is] . . . more loosely cellular and coarsely reticulate than the last [tunbrigense] . . ."

In fact, the cells in *H. wilsonii* are far larger, rectangular and conspicuously arranged in rows running obliquely to the segmental vein. In *H. tunbrigense,* they are smaller, more square, and appear to be arranged haphazardly. See FIGURE 14. To be more precise, the mature cells of *H. wilsonii* are 0·094±0·002* mm long, and those of *H. tunbrigense* 0·060±0·01 mm. The width of cells in surface view in both species is the same at 0·039±0·001 mm. GULLIVER (1863a, b) made an observation on the sizes, but not the arrangement, of these leaf cells when he also remarked on the inadequacy of J. C. Sowerby's figures in English Botany (HOOKER 1831). The gametophyte cells are likewise very different in size, having the same dimensions as the lamina cells described above.

* These dimensions are quoted along with the standard error of the mean.

It is interesting to note that the spores of each species also differ in size, and JESSEN & ANDERSEN (1959, p. 31) quote a range of 62–74μ diameter in *H. wilsonii* and 40–48μ diameter in *H. tunbrigense*.

One further convenient distinction applicable to both sporophytes and gametophytes lies in the number and size of the chloroplasts. *H. wilsonii* has very numerous small chloroplasts so that about 60–80 of them line the periphery of the cells as seen in surface view and this is easily separated at a glance from *H. tunbrigense* where only 30–40 can be counted. This criterion has proved to be especially valuable in identifying sterile fragments of old herbarium material in which, after soaking in water, chloroplasts become visible again.

The gametophytes of each species are very similar in form, being strap-shaped with many short rhizoids at least in culture, for they have never yet been detected free-living in nature apart from a few contained within the indusial valves of old sori. Shortly after germination they both show marked tri-radial symmetry, and this, according to STOKEY (1940) is a constant feature of the genus *Hymenophyllum* and commonly found in *Trichomanes* as well.

As both species are highly plastic in their sporophyte morphology, depending on the environment, a brief summary will be given here of the ranges encountered. (For a fuller account, see EVANS 1964).

The fronds of *H. wilsonii* are usually from 3 to 6 cm long and about 2 cm wide, but exceptionally this range can extend from 0·5 cm to 30 cm and to 15 cm in *H. tunbrigense* (see FIGS. 1–13). The smallest fronds are found in colonies on rocky surfaces liable to periodic droughts in very exposed positions in the mountains. In rather dark sites, where very high humidities are maintained constantly even during prolonged droughts, apical growth of the fronds persists from season to season in both species. In this way long etiolated fronds are produced often with rather distant pinnae. Not infrequently under these conditions the fronds are found with sori in spaced groups, each group corresponding to a season's crop; but note that there may be two growth seasons in exceptionally favourable years. On a few occasions I have found five such groups on a single frond. *H. wilsonii* produces longer fronds in lighter sites under constantly high humidity.

However, whilst the fronds may be potentially of unlimited growth, the great majority in practice must last for not more than two years, because periodic desiccation afflicts most colonies and kills the growing apex if not the frond itself. For instance, after four years not one of the many fronds that I had marked in North Wales in 1960 had survived.

In certain circumstances, such as in very humid places where diffuse light is abundant but where direct sunlight never falls on the fronds, *H. tunbrigense* can produce fronds of such unusual morphology that they cannot be separated easily from those of *H. wilsonii* without

recourse to anatomical criteria (see FIGS. 10 & 13). This problem arises not infrequently with herbarium material as collectors often prize unusual specimens. A very rare form of *tunbrigense* that I have only once succeeded in developing experimentally (in low light and above 90% humidity) possessed exceedingly numerous squarrose pinna segments, and each pinna seemed of indefinite growth so that the frond resembled a small bush. (see FIG. 8); similar fronds occur rarely in the field.

In conclusion I would add that there are important physiological differences between the two species, particularly in their reactions to low light intensities and to desiccation. *H. wilsonii* is sensitive to low light but very resistant to desiccation whereas *tunbrigense* is the opposite, being very tolerant to low light and very sensitive to desiccation. As a consequence the two species occupy relatively distinct microhabitats. Only very rarely does one come across a patch containing intermingled fronds of both species. When the two are grown together in low light then *H. tunbrigense* wins the battle aided by its smothering growth form, but in conditions subject to periodic and severe drought *tunbrigense* succumbs and *wilsonii* is the victor.

I am indebted to the Director of the National Museum of Ireland for permission to reproduce Fig. 13; to the Editors for arranging the figures; and to Prof. P. W. Richards who supervised my research. Also, I wish to acknowledge assistance from Abdul Samat b. Abdullah in typing and from Ja'affar b. Haji Abdullah in preparation of silhouettes.

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DRYOPTERIS VILLARII IN BRITAIN

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Dryopteris villarii (Bell.) Woynar has rather precise habitat requirements which restrict it to a small part of north west England with an outlying station at Llangollen in North Wales. It is abundant in only three localities: the hills of Ingleborough, Whitbarrow Scar and the Hutton Roof—Farleton Knott massive which all lie within 25 miles (40 km) of each other in the area where Yorkshire, Lancashire and Westmorland meet. Here the populations can be measured in hundreds or in the case of the Lancashire one in thousands of individuals. Many other hills in this general area carry smaller populations of the fern, for example it can be found on Scout Scar, Orton Scar, Great Asby Scar, around Malham Tarn on Wild Boar Fell, etc. It has recently been seen in twenty-one 10-km grid squares (see map on page 265).

This part of the country is the main area of outcrop of the Great Scar Limestone, a bed of very pure Carboniferous limestone over four hundred feet (130m) thick which produces typical karst scenery with much outcrop. The distribution and abundance of the fern can be correlated with its exposures to a remarkable degree. The mid and south Craven fault scarps which mark the junction of the Great Scar Limestone and the impure basin limestones of the Craven Lowlands support the most southerly colonies in England, while the most easterly ones are on the limestones overlooking Upper Wharfedale before they vanish under the Yoredale and millstone grit cover of the Pennine dip slopes. To the north, as limestones gradually become subordinate in the succession, the fern decreases and the last major appearance of the massive beds at Great Asby and around Brough correspond with its northern limit.

Great Scar Limestone country provides three types of habitat suitable for *D. villarii:* cliffs, screes and limestone pavement. If all localities known to the author containing twenty or more plants are scored, the following picture of habitat preference emerges: pavements (11 sites) 64%; scree (4) 24%; cliffs (2) 12%. As all these habitats are widespread these figures probably give a true picture. A comparison of them, together with other limestone habitats available to but unoccupied by the fern should give some indication of the reasons for its limited distribution.

Soils from these habitats are reasonably uniform being rendzinas grading into mull rendzinas where there is drift contamination. In appearance they are very dark with a well developed fine to medium

crumb structure. Mineral grains are intimately mixed with the black well decomposed humus and there is excellent incorporation by the abundant soil microfauna. At four to five inches (10–13 cm) this typically grades into a very stony, highly calcareous, humus silt loam which is usually moist. Analysis of several samples from around the roots of *D. villarii* have shown that it is a strongly alkaline soil with a high proportion of calcium carbonate and organic matter. The base exchange capacity is high and the carbon/nitrogen ratio of around 10 shows that it is very fertile (TABLE 1).

TABLE 1—Soil analysis from three localities of *D. villarii* on Ingleborough, Yorkshire.

Sample No.	Organic matter (per cent)	Calcium carbonate (per cent)	Carbon (per cent)	Nitrogen (per cent)	Carbon/ nitrogen ratio
1	15·2	26·8	7·6	0·70	10·8
2	22·6	29·4	11·3	1·03	11·0
3	29·5	55·4	14·8	1·25	10·9

Sample No.	pH of fresh soil	Exchangeable calcium*	Exchangeable potassium	Base exchange capacity
		(in mille-equivalents per 100g of soil)		
1	7·9	20·3	0·25	21·9
2	7·8	—	0·26	38·3
3	7·8	—	0·49	38·1

* only one observation made.

Sample No. 1 Mull rendzina. South facing scree slope.
No. 2 As for No. 1 but north facing block scree.
No. 3 As for No. 1 but limestone pavement.

In Britain this precise soil type is almost confined to mountain limestone areas, but similar soils can be found on other pure limestones such as the Chalk, Magnesium and Jurassic, indeed *Thelypteris robertiana* a fern closely associated with *D. villarii* grows on them all. So for this and other reasons such as its behaviour on garden soils and its occurrence near Brough on a mixed limestone and sandstone scree, it seems unlikely that soil factors do more than restrict it to well-drained base-rich soils.

The altitudinal range of the fern varies from sea level in Silverdale where the vegetation contains a strongly southern element (including *Adiantum capillus-veneris*) to 1600 feet (490m) on top of the Pennines where the highest D_1 limestones occur. Here snow is lying on an

average of forty-five mornings in the year and ground frosts are recorded every month (MANLEY 1957). When other limestone areas in Britain are compared for rain days, Meyer's precipitation/saturation deficit quotient, mean temperatures and sunshine, the sites which fail to match a part of the Silverdale—Craven Highlands belt are those

Distribution in the British Isles of *Dryopteris villarii*. Each dot represents at least one record in a 10-km square of the National Grid. The distribution of carboniferous limestone is shown by stippling; over much of its area it is obscured by glacial drift or intercalated with non-calcareous strata.

lying south of the Exe-Tees line. This leaves Derbyshire as a large limestone area where one might reasonably expect to find the fern. It does not follow that climatic factors are operating to exclude the plant from calcareous habitats south of the line, it just means they could be. An examination of its distribution outside Britain is of no help in determining its climatic limits as there is evidence that our plant is an endemic cytotype.

Topography seems to be the most important factor shaping the distribution of *D. villarii*. The plants are sensitive to wind exposure and grazing, so only sites offering sufficient protection are available to it and these are widespread only on the harder Palaeozoic limestones. A fewer simple experiments have verified this. In 1960 a colony on block scree near Malham Tarn was investigated. It had been noticed that by the end of summer most plants had been grazed, so stones were removed from around several clumps and replaced in such a way that the fronds were exposed to increased grazing but not to increased wind. Sheep graze sporadically on this barren scree slope and in 1961 they damaged fronds in all the experimental areas. Damage varied from being eaten to ground level to fronds with just the lowest pair of pinnae left and others still intact. The experiment was recorded yearly till 1965. It showed that increased grazing gradually weakened the plants, leaves annually getting fewer and smaller till after five years of existing for most of the time below the compensation point, reserve food in rhizome and leaf-bases was used up and many were dead while most of the rest were producing only a few stunted leaves.

Exposure to wind was also investigated after observing that on Whitbarrow Scar where fencing against deer has recently eliminated grazing, the tips of fronds were shrivelled and brown by mid-July. The experiment, also carried out at Malham Tarn, involved moving well grown ferns from the scree slope to a nearby ungrazed limestone pavement where they were planted out into grykes (fissures) of different depths. Results indicated that at least six to eight inches (10–15 cm) of sheltered air above the rhizome is needed if plants are to survive. Those in situations where this requirement was met were still growing healthily and producing spores five years later, while those in more exposed sites were either dead or growing with very reduced vigour. These produced typical crops of leaves for the first year or two but by August they were always brown and withered. A second crown of small (2–3 inch, 5–7 cm) rather leathery leaves was sometimes produced and lasted until autumn. After two or three years all those in exposed sites were producing these as the first crop. The plants must then be photosynthesising at a net loss throughout the year and be incapable of maintaining the species on these sites.

The absence of *D. villarii* from the fragments of ash (*Fraxinus excelsior*) and other deciduous woodland which have survived on these northern limestones serves to illustrate its intolerance of all but the lightest shade. Where it does occur on partly wooded pavement it is always in glades which receive a lot of sunlight.

So *D. villarii* has as its basic requirements a well drained calcareous soil in an open or only lightly shaded site which offers protection from grazing and strong winds. This is an unusual combination for a fern with fronds which are typically about eighteen inches (46 cms) long, and must be largely responsible for its restricted distribution. The only habitats where they are fulfilled are (i) on block limestone scree with a good proportion of the blocks over two feet (60 cms) in diameter—strikingly demonstrated on the Eglwysen Mountain cliff complex at Llangollen where the colonies are located on the only streaks of coarse scree; (ii) limestone pavement with fairly wide, broken sided grykes which allow reasonable light penetration and good opportunities for rooting; (iii) —and most restricted— low sheltered cliffs with a north to south-east aspect.

These habitats support the same very uniform plant community. It is extremely fern-rich and associates vary from shelter-demanding woodland plants, to grassland and tall herb species. Bryophytes are well represented and many are calcicolous species. The following species were over 80% constant in ten widely separated colonies which covered at least two examples of each habitat type: FERNS: *Asplenium ruta-muraria, A. trichomanes, A. viride, Cystopteris fragilis, Dryopteris villarii, Thelypteris robertiana* (70%), *Phyllitis scolopendrium;* ANGIOSPERMS: *Festuca ovina, F. rubra, Geranium robertianum, Mycelis muralis, Oxalis acetosella, Sesleria varia, Taraxacum officinale* (agg.), *Viola riviniana;* BRYOPHYTES: *Camptothecium sericeum, Conocephalum conicum, Ctenidium molluscum, Encalypta streptocarpa, Fissidens* sp., *Grimmia apocarpa, Mnium undulatum, Neckera crispa, Tortella tortuosa.*

No worthwhile discussion of the history of the species as a member of the British flora can be undertaken without considering reports of it from three mountainous areas: Snowdonia, Arran, and the Lake District. The Snowdonia records made by J. E. Griffith from Cwm Idwal (1884) and Cwm Glas (?1887) are quite reliable, the former being backed up by correctly named herbarium specimens. These two cwms contain Ordovician rocks which at certain levels are strongly basic (WILLIAMS 1927) and it was doubtless on these strata that the fern was found. It appears that Griffith is the only person to have seen *D. villarii* in this area, but local botanists are confident it will be rediscovered. The only information available from Arran is a note in the Proc. Nat. Hist. Soc. Glasgow, Vol. 4, pt. 2. "Mr Stewart exhibited *Lastrea rigida* from Arran, its first discovery in Scotland, 1879." The presence of

thick beds of very pure carboniferous limestone on the island means the record must be taken seriously. The Lake District records were all made this century from Honister Crag. Small plants have been seen on three or four occasions on quarry debris and the suggestion is the spores must come from a larger colony on some inaccessible part of the crag. The rock is not unsuitable, being Borrowdale Volcanic Series with local heavy calcite veining and many of the usual associates of *D. villarii* occur on the cliff. These records are important because they give the fern a much wider distribution than could be imagined from its present one.

Disjunct distributions of this type are not unusual and can be satisfactorily interpreted as a spread during the Late Glacial becoming restricted during the post-glacial forest period and subsequent expansion again with human clearance. The most likely refugia for *D. villarii* were the limestone cliffs which rose above the tree cover (PROCTOR 1958). These occur in reasonably close proximity to many of the present-day localities. It is possible that some of the higher limestone pavements never had a complete tree cover, and the presence of *Polystichum lonchitis* growing with *D. villarii* on three such pavements in Craven and an old record from Farleton Knott would seem to bear this out.

The history of the fern in Britain is of some interest as we apparently have an endemic tetraploid race ($n=82$; Farleton Knott, Whitbarrow Scar, Ingleborough, Brough, Leck Fell), while the few counts which have been made on the Continent show it to be diploid ($n=41$; France, Switzerland).

PANIGRAHI (1965) who has looked at the cytogenetics of specimens from Ingleborough considers the British plant to be an allopolyploid to which the continental diploid is ancestral. If this is so, our plant, a sexual fern of hybrid origin, probably deserves specific rank.

Should continental material prove to be exclusively diploid there would be a case for considering part of the *D. villarii* complex having survived at least the last glaciation of Britain. Further speculation is unwise until more is known about the continental populations and about the Ice Age in Britain (DUNHAM & JOHNSON 1963).

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ORIGIN OF THE FERN FLORA OF TRISTAN DA CUNHA*

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The islands of the Tristan group are remarkable for their isolation in the south Atlantic about 1800 miles west of South Africa and 2000 miles east of South America. They are also remarkable in that nearly half of the indigenous vascular plants are pteridophytes. I will present here the distribution of these and of some of the flowering plants and animals and from this evidence draw conclusions on a source of origin and a manner of dispersal of the Tristan biota.

GENERAL DESCRIPTION AND HISTORY

There are three main islands in the Tristan group—Tristan, Inaccessible and Nightingale and I also include Gough Island, some 200 miles south-east, which has a similar flora and fauna that has recently been surveyed by British scientific expeditions.

The climate is oceanic. The average temperature of Tristan is 54° F. with a range of 38–75° F. Rainfall of 66 inches is evenly distributed through the year and the prevailing winds are from the west. There are frequently violent storms particularly affecting the western portions of the island. The islands are believed to be of Tertiary age and the main masses are basaltic lava. There are evidences of older, local eruptions similar to that which occurred in the fall of 1961, when the settlement was evacuated.

The vegetation of Tristan has been studied by WACE and HOLDGATE (1958) and that of Gough by WACE (1960, 1961). I am much indebted to Dr N. M. Wace for the photographs used here as well as for data from his vegetational studies. There is a marked similarity in the flora and fauna of the Tristan archipelago and that of Gough, and plant associations within the larger vegetational divisions appear to be common to all of the islands studied. Differences are ones explained mainly in the diverse topography. Gough is smaller, rectangular, with topography irregular and the highest point, Edinburgh Peak, is 2730 feet. Tristan, the largest island, has a circular form and the vegetation is strongly defined by topography and altitude into four main zones. The *lowland plains*—a limited area along the coast on which the settlement is located that has been farmed and grazed. There are narrow beaches, grassland and mires, and many introduced species occur here. The *cliffs* form an abrupt barrier around most of the island, are nearly vertical to 45°, and extend up to 1000 feet. Heath, scrub and grassland associations occur on the flanks or ridges and level terraces. On steeper slopes there are frequent eroded areas caused by peatslips. The

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base forms a plateau about a mile wide between 1000 and 3000 feet completely surrounding the island. This is the richest area for ferns and about half of the species on the islands are found here in the vegetational unit—the pteridophyte association. The *peak* from 3000–6760 feet, the highest point, has a crater containing a lake and the vegetation consists of grassland, heath and alpine desert. The varied topography within each of these zones provides an abundance of habitats suitable for pteridophytes. Thirty-three species are reported from Tristan and 26 from Gough.

Spores of *Ophioglossum, Hypolepis, Vittaria, Grammitis, Hymenophyllum, Eriosorus* and others not readily identifiable occur in peat samples taken in studies of the Pleistocene vegetation by HAFSTEN (1960). The lowest level of peat has been radio-carbon-dated at nearly 5000 years. Two pollens of special interest, *Nothofagus* and *Ephedra,* also occur in these samples although neither genus occurs on the islands. The *Nothofagus* pollen has been identified as *N. pumilio* which occurs in Patagonia and has occurred there throughout the Quaternary. This and the *Ephedra* pollen are considered records of long distance dispersal from South America.

The earliest collections from Tristan were made by Aubert du Petit-Thouars in 1793. His *Esquisse de la Flore de Tristan d'Acugna,* including descriptions of 16 pteridophyta, was published in the *Mélanges de Botanique et de Voyages* (1811). It has recently been noted by Mrs M. J. van STEENIS-KRUSEMAN (1964) that a printed copy of the *Esquisse* was presented to the French Academy as early as 24 October 1808 and thus the descriptions of 13 species of pteridophytes based on this work should have the earlier date. Collections of Thouars are in the Muséum National d'Histoire Naturelle at Paris, and those I have examined are ample and well prepared specimens.

The revision of the Tristan pteridophytes by CHRISTENSEN (1940), one of the results of the Norwegian expeditions to Tristan, is the most complete account of the vascular plants. The following list is largely a compilation from this work and also that of WACE (1961) with emendations from recent studies and comments upon the species or specimens that I have examined. It is not possible to make final taxonomic decisions in many cases as this awaits comprehensive studies of species throughout their ranges. It is, however, possible to draw reasonably accurate conclusions on the geographic relationships of the species.

The pteridophytes of the Tristan islands can be grouped geographically into three main classes: *South American*—those with the same or closely related species in South America and not in Africa, these may also be more widely distributed especially in Australia and New Zealand; *Amphiatlantic*—those which occur or have close relatives in both America and Africa; *African*—those in Africa and else-

where but not South America.

SOUTH AMERICAN PATTERN

Species occurring in the Tristan group and the same or closely related species in South America and usually elsewhere, but not in Africa.

Ophioglossum opacum R. Br. is a rare species occurring on the higher slopes of the mountains, on coarse, rocky soils of the moorlands. On the basis of a collection from St. Helena, CLAUSEN (1938) maintained the species but noted that it has a bulbous stem similar to *O. crotalophoroides* Walt. and that it was treated by Prantl under this species which ranges from the south-eastern United States south into Chile.

Hymenophyllum aeruginosum (Poiret) Carm.—on shaded rocks or fallen tree fern trunks. This is one of the Sphaerocionium group having branched trichomes on the leaves and is very close to if not the same as the Chilean *H. ferrugineum* Colla.

Eriosorus cheilanthoides (Sw.) A. F. Tryon*—among rocks in fern scrub or forest edge. With the exception of this species in the Tristan group the genus is wholly American, occurring from southern Mexico to Bolivia and Brazil. The unique spores are found throughout the samples from the lowest levels to the recent and record the occurrence of this species throughout the Pleistocene. Specimens from Tristan are not distinguishable from some occurring in the Andes, formerly called *E. elongatus* (Grev. & Hook.) Copel. or *E. flabellatus* (Grev. & Hook.) Copel.

Vittaria vittarioides (Thouars) C. Chr.—a forest species occurring on rock ledges or crevices; Christensen regarded it as an endemic related to American species. It is distinct from those of the Andes in having deeply sunken soral grooves some distance from the margin, branched paraphyses and large, yellow, tetrahedral spores.

Blechnum penna-marina (Poiret) Kuhn—a herbaceous member of the Lomaria group, it has the widest ecological tolerance of any of the Tristan ferns for it occurs on the strand as a colonizer on up to the peak where it may be a dominant (Plate IIB). The species has been reported to be diploid n=34 in New Zealand.

Asplenium alvarezense Rudmose Brown—an ephiphyte, frequent on Blechnum trunks. Christensen considered it endemic but closely related to *A. magellanicum* Kaulf. (*A. dareoides* Desv.) which grows on arborescent ferns in Chile.

Dryopteris aquilina (Thouars) C. Chr.—forms dense layers with leaves up to a metre tall, under Phylica trees. It is one of the Ctenitis

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*__Eriosorus cheilanthoides__ Sw.) A. F. Tryon __comb. nov.__
Grammitis cheilanthoides Sw., Syn. Fil.: 23, 219, 419 (1806), 'Ins. Mauritii' in error.

group very close to, if not the same as, the Chilean *D. spectabilis* (Kaulf.) C. Chr. Christensen regarded the plants of Tristan as distinct on the basis of their coriaceous leaves with strongly enrolled margins and a mixture of hair and scales, but the specimens that I have examined from Chile cannot be differentiated on these characters.

Grammitis magellanicum Desv.—among mosses, epiphytic on rocks or dead tree trunks. Christensen noted the relationship of these plants to *G. billardieri* of Australia and New Zealand but regarded them as distinct because of their nearly sessile and glabrous leaves. A broader concept of the species is taken by SOTA (1960) in a treatment of the genus in Argentina. The South American material is included as a variety of *G. billardieri* Willd. and the Tristan plants appear to belong here as var. *magellanica* (Desv.) Sota f. *nana* (Brack.) Sota on the basis of the small size of the leaves.

Lycopodium diaphanum Sw.—in scrub and forest, usually in drier sites. This is one of the clavatum group closely related to *L. contiguum* Klotz. of South America as shown by the sessile strobili with long, attenuated yellow sporophylls.

Other species having distribution patterns similar to those of species noted above are: *Trichomanes angustatum* Carm., *Asplenium obtusatum* Forst. f., *Dryopteris parallelogramma* (Kunze) Alston, *Polystichum mohrioides* (Bory) Presl, *Azolla filiculoides* Lam., *Lycopodium magellanicum* Sw. Fifteen species appear to be represented in South America by the same or closely related species.

AMPHIATLANTIC PATTERN

Species occurring in the Tristan group and the same or closely related species in South America and Africa are usually elsewhere.

Histiopteris incisa (Thunb.) J. Sm.—one of the predominant species in moist, open places of the fern bush community occupying up to 90% of the field layer. A beetle, *Coninomus,* occurs almost exclusively on this fern and is abundant on Gough where the *Histiopteris* is most frequent.

Adiantum poiretii Wikstr.—on wet rocks, walls and cliffs. The species was described from a collection of Thouars from Tristan but is widely distributed in the American tropics and Africa. Christensen indicated that the species was likely an endemic but also noted that some of the collections he examined agreed with forms from the continents. PICHI-SERMOLLI (1957) considers this distinct from the African material which he calls *A. thalictroides* Willd. & Schlecht. Chromosome reports of 2n=114 and n=60 add further complexities, all of which may be resolved by studies of the plants throughout their range.

PLATE II

A, above) Phylica bush with *Blechnum palmiforme* in foreground, about 4 feet high, Sandy Point, Tristan. B) *Elaphoglossum succisifolium* and *Blechnum penna-marina* at 1000 feet in the Glenn, Gough. Both photos by N. M. Wace.

Blechnum palmiforme (Thouars) C. Chr.—often forms tree fern thickets (PLATE IIA) dominating extensive tracts sometimes with the other arborescent plant, *Phylica arborea* Thouars, a member of the Rhamnaceae. The trunks are up to 3 feet (1 m) and the crown about 3 feet in diameter. It belongs to the Lomaria group along with *B. tabulare* (Thunb.) Kuhn of South Africa and *B. magellanicum* (Desv.) Mett. of Chile. SCHELPE (1952) in his revision of the South African blechnums indicates that the plants of this complex in Tristan and South America are probably distinct from the African.

Blechnum australe L.—a herbaceous species of the Blechnum group tolerant of moist or dry sites and salt spray belongs to a closely related group occurring in both America and Africa. The American plants have been segregated as *B. auriculatum* Cav., on the basis of the adnate condition of the pinnae, but this is hardly a reliable character. A revision of the South American species is in progress by Maria Teresa Murillo, Curator of Ferns at Bogotá.

Asplenium monanthes L.—among rocks in exposed places or in tree fern scrub. It is surprising that this species has a relatively limited distribution in the islands for it is commonly occurring and wide ranging in Africa and America. Plants from Madeira have been reported to be apogamous triploids; thus, studies of the species in other parts of its range should be of much interest.

Rumohra adiantiformis (Forst. f.) Ching—on broken terrain on drier places in the fern bush and on talus receiving salt spray. The size and division of the leaves are highly variable and several geographical varieties have been recognized. The circular form of the sori and numerous, broad petiole scales denote its relationship to *Polystichum*.

Elaphoglossum hybridum (Bory) Moore—on moss-covered rocks in the forest. Plants from these islands are identical with specimens from Réunion and from southern Brazil. This and the following more frequent species are unfortunately not sufficiently studied, for they represent a most interesting genus widespread in both America and Africa.

Elaphoglossum succisifolium (Thouars) Moore—in large colonies (PLATE IIB) in a variety of habitats from 150 to 1800 feet. It has large, coarse leaves with tan, lacerate scales on both surfaces of the lamina and petioles.

Other pteridophytes having amphiatlantic distribution patterns similar to those discussed above are *Hymenophyllum peltatum* (Poiret) Desv., *Hypolepis rugosula* (Labill.) J. Sm., *Asplenium erectum* Bory, *Athyrium medium* (Carm.) Moore, *Thelypteris tomentosa* (Thouars) Ching, *Elaphoglossum obtusatum* (Carm.) C. Chr., *E. insulare* C. Chr. and *Lycopodium insulare* Carm. Seventeen species have the same or closest relations with species in both America and Africa.

AFRICAN PATTERN

Asplenium platybasis Kunze.—known from only a single collection from the Phylica forest on Inaccessible Island. Christensen proposed a

variety, *subnudum* to distinguish this from the typical form on St. Helena having denser indument. He indicated the relationships of these to *A. friesiorum* C. Chr. in Africa and the wider ranging *A. falcatum* Lam. This is a notable record for the islands as it is the only species among the pteridophytes having its closest relatives in Africa without any American relatives. These relationships however should perhaps be regarded as tentative until the species from both of these areas are more closely studied.

OTHER BIOTA

It is of interest briefly to review pertinent data on the distributional ranges of certain flowering plants, invertebrate animals and birds where these give indications as to the origins of the flora and fauna.

The flowering plants* of Tristan have not been adequately surveyed but these are estimated at between 30 to 40 species about half of which are considered to be endemic. Eight are the same or have closely related species in South America and four occur only in the southern part of the continent; five occur in Australia and New Zealand and only one occurs in Africa. The following few illustrate these ranges.

Lagenophora nudicaulis (Comm.) P. Dus.—a minute composite of the tribe *Asterae,* usually less than 3 inches tall, occurs in Tristan and Chile. BEAMAN & DE JONG (1965) in a recent paper on the American species of *Lagenophora,* which have a disjunct distribution in the Andes, note that the fruits or sticky glandular achenes are well adapted for long distance dispersal.

Empetrum rubrum Vahl—a heath-forming plant of the *Empetraceae*. It occurs frequently with *Blechnum penna-marina,* is ubiquitous in all vegetational zones up to the peaks and has reddish-black drupes. It grows only on these islands and southern South America and adjacent islands.

Phylica arborea Thouars (*Rhamnaceae*)—the dominant arborescent plant in the islands which often occurs with *Blechnum palmiforme*. This is the only species of flowering plant which has largely African relations. The species also occurs in the New Amsterdam and Mascarene islands but the genus centers in Africa.

Acaena stangii Christophersen (*Rosaceae*)—resembling *Potentilla* in its habit, has fruits with retrorse barbs. The genus is mainly of the southern hemisphere but with disjunct species in California and Hawaii.

Hydrocotyle capitata Thouars (*Umbelliferae*) is a small, creeping plant considered to be endemic to the islands, but belongs to an austral complex having members in South America and New Zealand.

The fauna of the Tristan group, like the flora is rela-

*While this paper was in press, an account listing about 600 plants (including 41 flowering plants) has been published by N. M. WACE & J. H. DICKSON 1965. The biological report of the Royal Society Expedition to Tristan da Cunha 1962, Part II The terrestrial botany of the Tristan da Cunha islands. *Phil. Trans. R. Soc. London Ser.B.* 249:273-360.

tively sparse. There are no mammals, amphibians, reptiles or fresh water fishes, but mostly invertebrates. HOLDGATE (1960) reports the composition of the fauna as 107 marine forms and 87 terrestrial ones, only eight of which are considered to be good faunistic indicators and all of these show strong affinity to American species. Three different groups Turbellaria (*Procerodes ohlini*), Diptera (*Ornithomyia remota*) and Coleoptera (*Lancetes varius*) show closest relations with forms in southern South America. Of 37 terrestrial and freshwater species having clear affinities outside of Tristan, 31 are closest to South American forms and only six are close to Old World or African species. There is a high correlation of the invertebrates on Tristan with forms captured in high altitude trapping including such flightless ones as springtails, spiders and mites.

The birds are perhaps the best known group and there is record of 33 species—21 breeding there and seven endemics, including a flightless rail on Inaccessible. There are five finches, four closely related, and on a smaller scale these show the effect of adaptative radiation much as the Darwin finches in the Galapagos islands. Non-resident birds include seven American species, among them the Barn Swallow and the Purple Gallinule, both having their nearest stations in Brazil some 2000 miles and about 40 flying hours away. There are also seven American Lepidoptera on Tristan.

CONCLUSIONS

It is well established that the islands are of volcanic origin and probably of late Tertiary age and thus they have been available for colonisation only since that time. It is generally accepted that if South America and Africa were at one time united they reached their present position by the Jurassic—too long before the Tristan islands were formed to have had a role in the origins of their present flora. The position of the islands on the mid-Atlantic Ridge suggests the possibility that there may have been past isthmian links over which migrations from the continents could have occurred. However, the paucity and composition of the pteridophyte flora, as compared to those of South America and Africa, do not support this possibility. There is a notable absence of such families as *Cyatheaceae, Gleicheniaceae* and *Schizaeaceae* and of such genera as *Pteridium, Pteris* and *Polypodium,* and particularly of the heterosporous genus *Selaginella.* All of these families and genera are prominent members of the fern floras of South America and Africa. Migrations across land connections or island archipelagos would be expected to result in a richer flora than the islands have and one that contains a better representation of the predominant elements of the adjacent continents.

The poverty and composition of the pteridophyte flora is consistent with migration by wind dispersal over long distances where the element

of chance becomes an operational factor. The kinds of propagules of the plants, as the light fern spores produced in copious quantities, the sticky achenes of *Lagenophora* and barbed seeds of *Acaena,* are also consistent with long distance dispersal by air. It is evident that the biota of the islands is composed of forms that are at one stage capable of transport by air, being light, adapted for flying or clinging.

The prevailing westerly winds which bring violent storms across the south Atlantic are also consistent with this means of dispersal and the biotic relations.

The source of the flora and fauna may be determined by relationships with those of other areas. It is evident that these relationships are predominately with South America and this is especially clear in the pteridophyta. Among the 33 species, all but one have relatives or occur themselves in South America, and 15 of these do not occur in Africa; eight are only American having species in Tristan and America or are endemic on Tristan and other oceanic islands with close relatives exclusively in America. Seventeen of the 33 species have African relations as well as American ones and a single species has wholly African relations. The relationships of the pteridophyta, a large number of the flowering plants and the known faunistic indicators are predominately with South American species. Thus it is reasonable to account for the largest part of the Tristan biota by means of air-borne immigration from South America.

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SOME RECENT WORK IN WALES ON THE *POLYPODIUM VULGARE* AGGREGATE

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INTRODUCTION

The existence of three cytotypes within *Polypodium vulgare* was described by MANTON (1950), and SHIVAS (1961, 1962) published a study of these cytotypes in which she treated them as species—*P. australe* Fée (diploid), *P. vulgare* L. sens. str. (tetraploid) and *P. interjectum* Shivas (hexaploid). The present writer came to study the group while working on the Merioneth Flora and the result is some information that is thought to be new and worth putting on record, concerning annulus characters, size of stomatal guard-cells, habitat, and geographic distribution. All the material studied was identified from morphology and spore fertility.

HYBRIDS

Early in the study it became clear that the pentaploid hybrid *P. interjectum* × *vulgare* is common in those parts of Wales where both the parent species grow; plants which from their morphology and sterility were obviously hybrids were continually found, and they are now known from sixteen stations in ten 10-km National Grid squares in Merioneth alone. No doubt they are equally common elsewhere.

Often this hybrid can be distinguished in the field by its tendency to grow in robust leafy masses with the parents on roadside walls, and by having mostly abortive sori. It often combines the coarseness of *P. interjectum* with the dark-coloured annulus of *P. vulgare*; it is intermediate in the mean width of the annulus (74–80μ), in the number of indurated annular cells (most often 9 or 10), and in the length of typical stomatal guard-cells (53–65 μ); and it has a high proportion of sterile spores. More will be said about the annuli and stomata.

The abundance of *P. interjectum* × *vulgare* and its morphological intermediacy between the two closely similar parent species make the recording of these species unwise without observation of spore fertility or a chromosome count.

Fortunately *Polypodium* spores are produced in great quantity and are relatively large; even with a strong hand-lens one can make out the difference between those of the species (more or less uniform in size and bright-yellow colour) and those of the hybrids (a mixture varying from normal in size and colour to small shrivelled and white, with some abnormally large).

No plants suspected to be either of the other two possible hybrids within the group (the triploid *P. australe* × *vulgare* or the tetraploid *P. australe* × *interjectum*) were met with.

ANNULUS CHARACTERS

MANTON (1950) and SHIVAS (1961, 1962) refer to differences between the three species in the number of indurated (hinge) cells in the annulus of the sporangium. This is one of the most useful distinguishing characters, though not an absolute one; Shivas shows that there are overlaps between the species and suggests that a determination should be based on a minimum of 25 annulus counts, and ROBERTS (1966) has found that the overlaps between *P. australe* and the other two species are even greater than was thought.

However, in examining a large amount of material for this character the writer came to recognise that the colour of the annulus is probably the most reliable non-microscopic character for distinguishing between *P. interjectum* and *P. vulgare*, the two members of the aggregate most commonly met with. In *P. vulgare* the dehisced sporangia are pale-buff with red-brown annuli and they gape wide open, exposing the annuli and making them yet more conspicuous; even with a hand-lens the annulus can clearly be seen as a dark line on the sporangium. In *P. interjectum* on the other hand, the dehisced sporangia are pale golden-brown with the annuli hardly differing in colour, and even in dry conditions the two halves of the sporangium remain more concave and half-closed, partially concealing the inconspicuous annulus. Annulus colour is of little use for distinguishing *P. australe*, which falls more or less between the other two species. The annuli of *P. interjectum* × *vulgare* are usually similar in colour to those of *P. vulgare*.

The three species and the pentaploid hybrid all have different ranges of annulus width (see FIGS. 1–5). Here again the differences, though a useful guide, are not absolute, except possibly between *P. vulgare* and *P. interjectum* which can usually be separated by a minimum of five annulus measurements per plant. The following figures are the ranges of means of ten plants of each species and the hybrid, obtained by measuring the width of five annuli (pressed flat) in each plant: *P. vulgare* 67–75 μ, *P. interjectum* × *vulgare* 74–80 μ, *P. interjectum* 76–86 μ, *P. australe* 81–100 μ. The individual measurements are shown in the histograms FIGS. 4 & 5. In *P. australe* the indurated cells are shorter than in the other taxa; that, combined with their smaller number, gives the annulus a distinctive closely-packed appearance (see FIG. 3). ROBERTS (1966) has studied this characters and produced statistical evidence.

STOMATAL GUARD-CELLS

The three species and the pentaploid hybrid also have different ranges of stomatal guard-cell length. Figures were obtained by measuring a single stoma, visually selected as typical, in each of 250 plants—80 each of *P. vulgare* and *P. interjectum*, 50 of *P. australe*, and 40 of *P.*

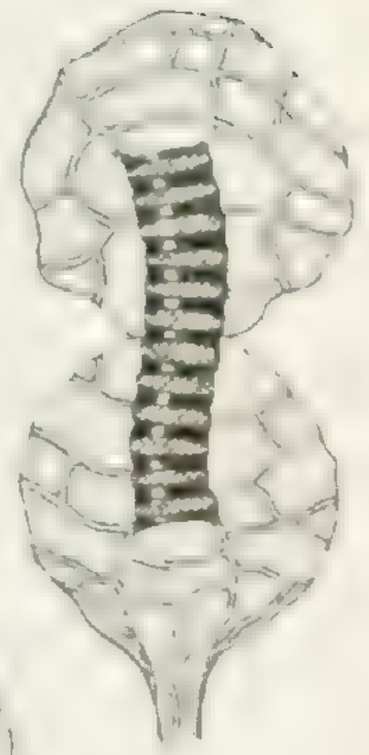

FIG. 1

FIG. 2

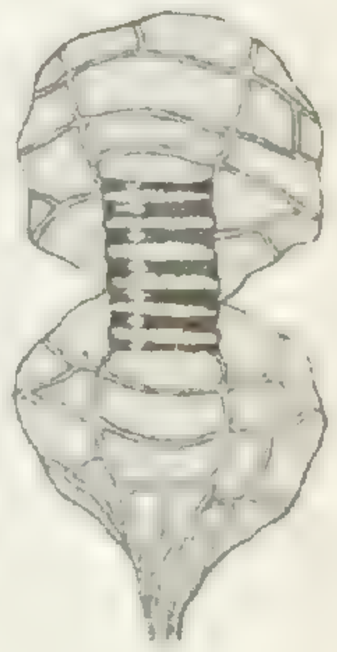

FIG. 3

500 μ or 0·5 mm

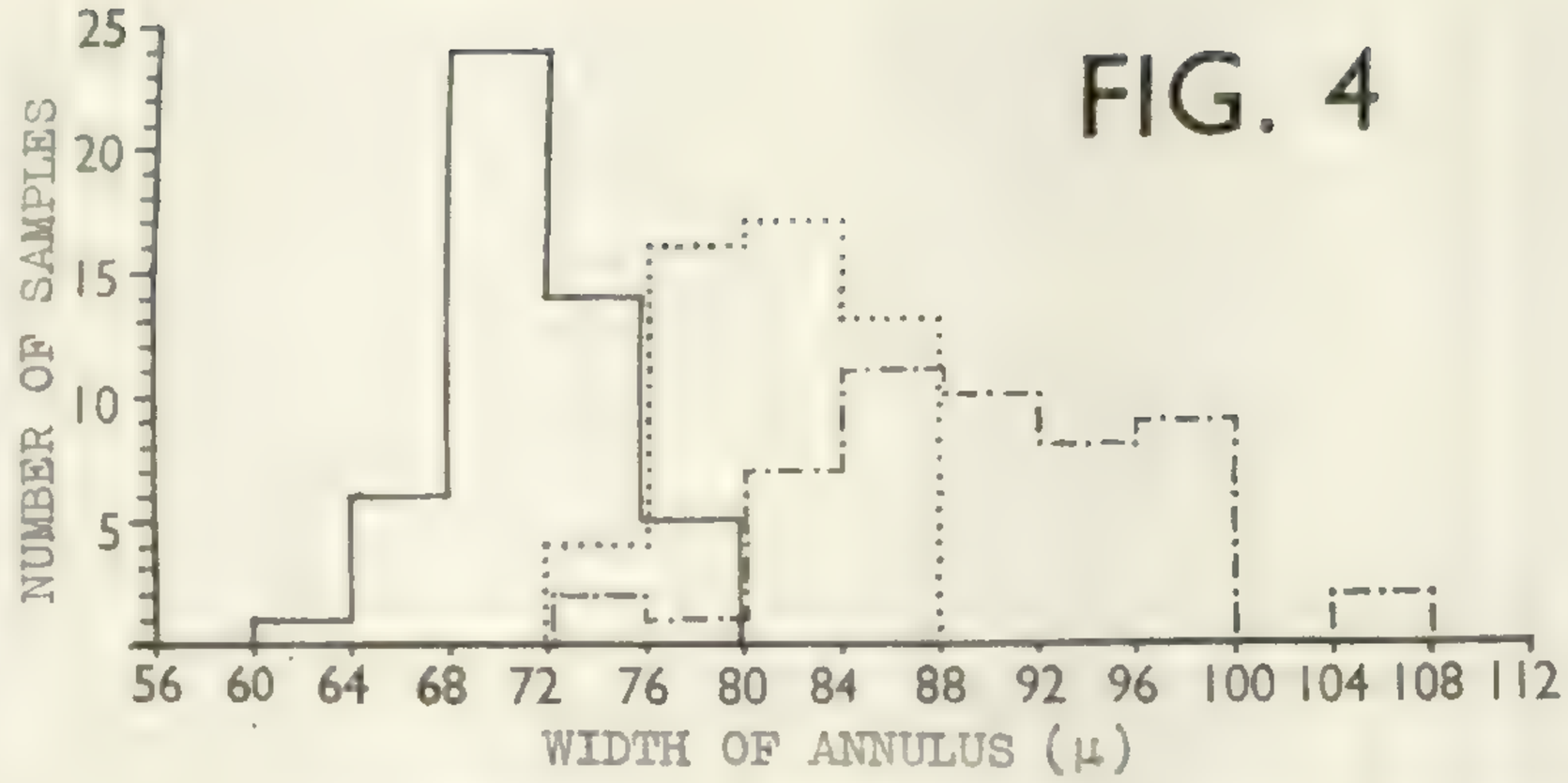

FIG. 4

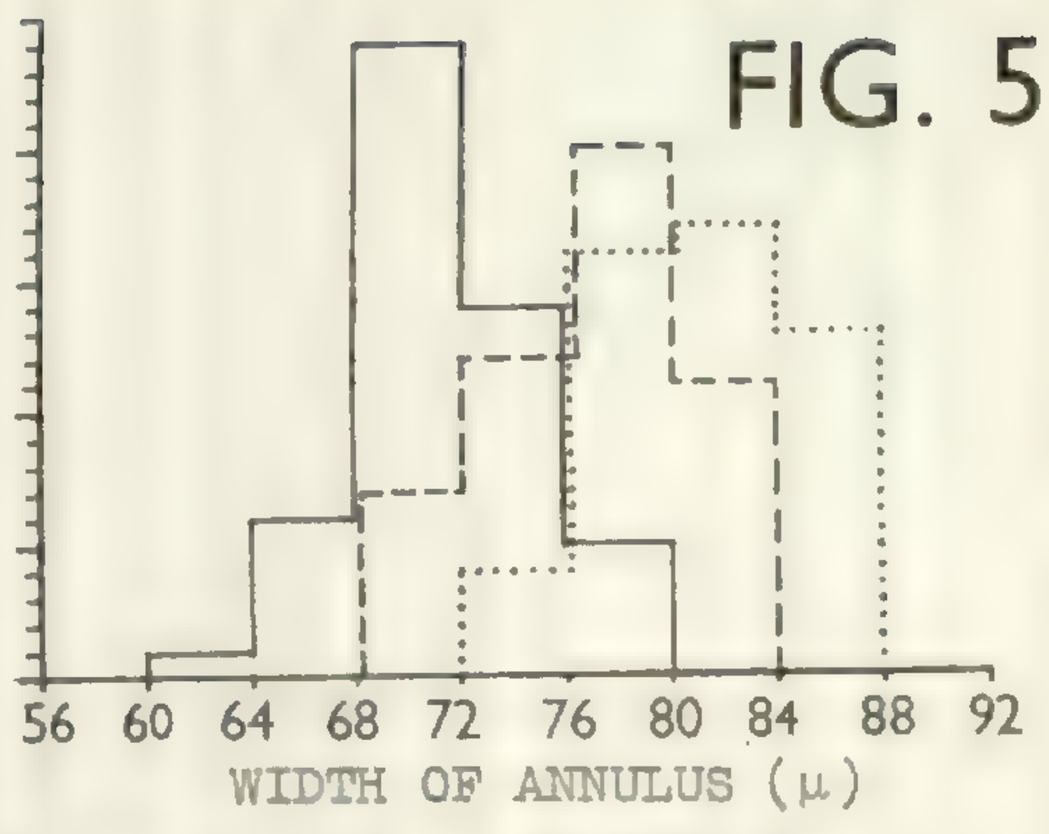

FIG. 5

vulgare — · — · — australe — — — interjectum × vulgare ····· interjectum

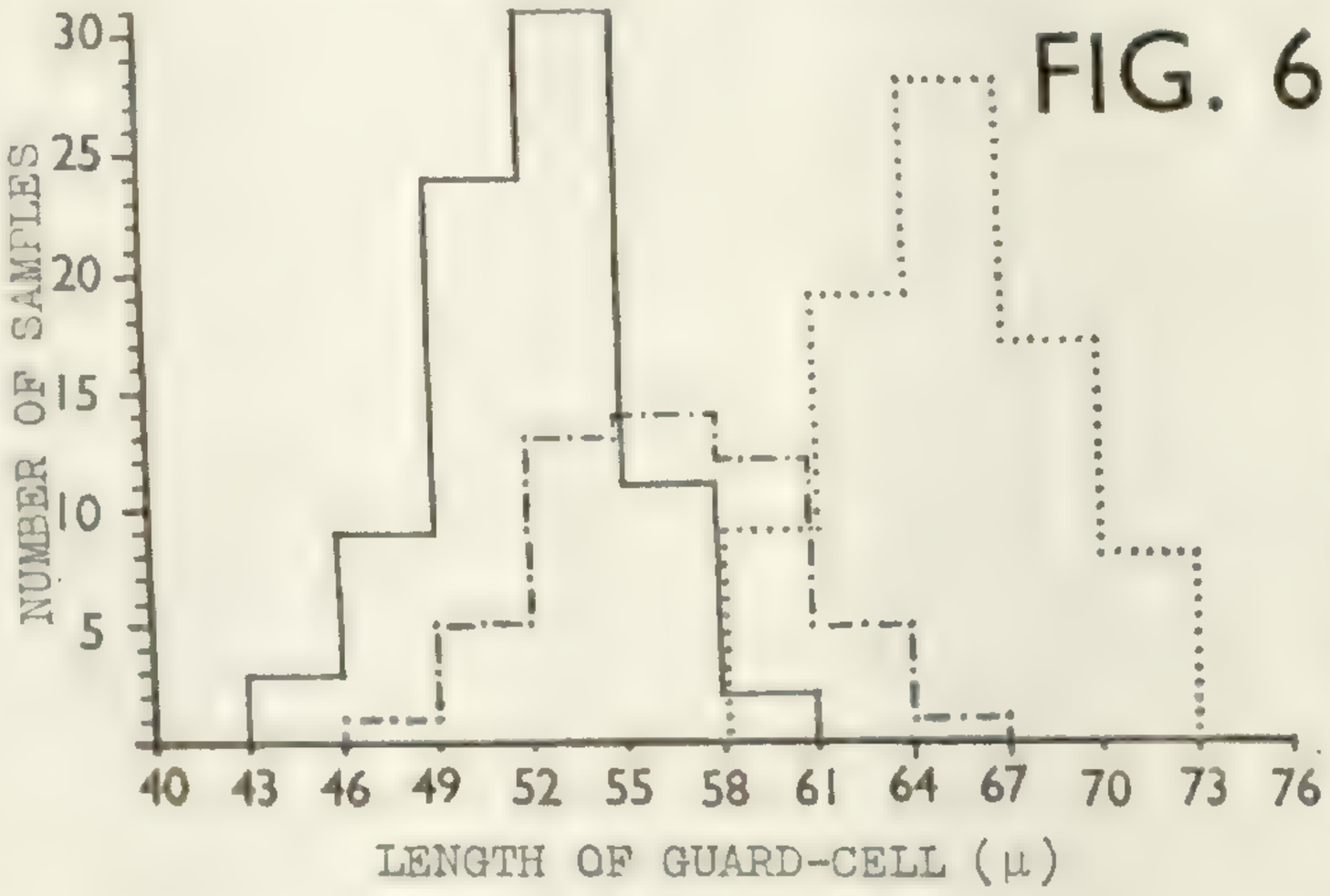

FIG. 6

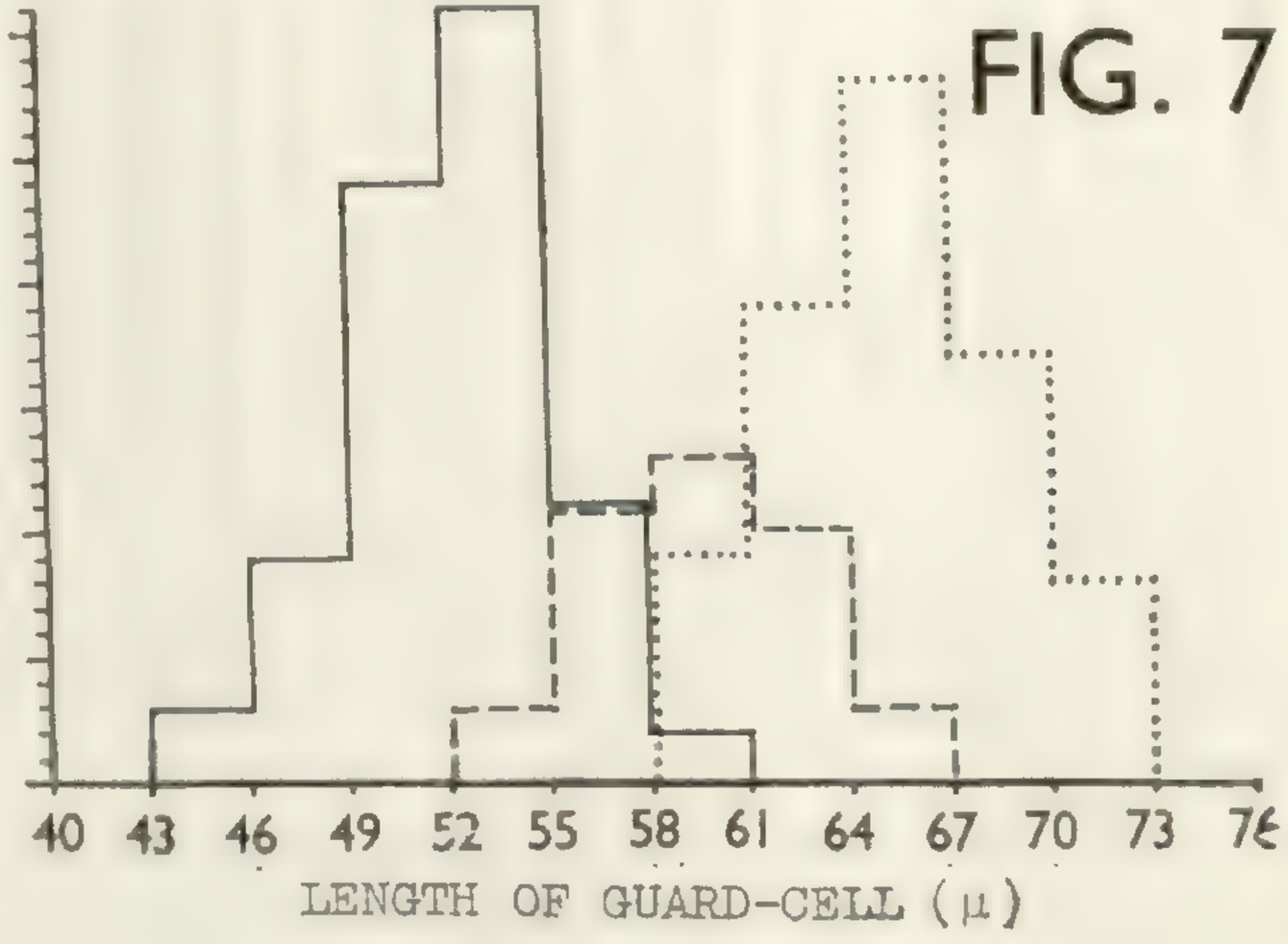

FIG. 7

FIGURES 1 – 3 Sporangia showing the characteristic annuli: 1) *Polypodium vulgare*, 2) *P. interjectum* and 3) *P. australe*.

FIGURES 4 – 7 Histograms of annulus and guard-cell characters in *Polypodium*.

interjectum × *vulgare*. A piece of epidermis from the underside of the basal pinna in each frond was placed in a drop of water on a microscope slide. The epidermis specimens were taken from fresh fronds, except in the case of the rarer *P. australe* where observations were made from dried material but, to counteract the shrinking effect of drying, the epidermis was soaked in cold water for some hours before being examined. Care was taken to sample poor and robust plants as well as typical ones. The histograms FIGS. 6 & 7 were constructed from the results.

Figures obtained for stomatal guard-cell length are: *P. vulgare* 43–58 μ, *P. interjectum* × *vulgare* 53–65 μ, *P. australe* 48–65 μ, *P. interjectum* 58–71 μ. The ranges of *P. vulgare* and *P. interjectum,* the two common (and indeed in many parts of Britain the only) species are almost discrete; in 80 samples of each of these two, the only overlap is of two samples of *P. vulgare* and four of *P. interjectum,* all with 58 μ guard-cells. *P. australe* and *P. interjectum* × *vulgare* are both intermediate in this character though their ranges differ.

Thus, leaving aside *P. australe,* which is rare or absent in most districts and has a distinctive frond shape that is fairly easily recognised, stomatal guard-cell length would be an almost infallible guide to barren *Polypodium* material but for the existence of the pentaploid hybrid. Unfortunately, that is too abundant to be ignored. Nevertheless the length of the stomatal guard-cells remains a useful supplementary character.

The almost exact intermediacy of *P. interjectum* × *vulgare* in this character is noteworthy. In the histogram FIG. 7 the modal class of the hybrid is the same as the uppermost class of *P. vulgare* and the lowermost of *P. interjectum*; the extreme classes of the hybrid are the same as the modal classes of *P. vulgare* and *P. interjectum* respectively; and 27 samples of the hybrid come within the range of *P. vulgare* and 26 within the range of *P. interjectum.* The distribution of annulus width in the hybrid (FIG. 5) shows similar features. This is excellent evidence of hybridity.

Although *P. interjectum* × *vulgare* is so common and produces some normal-looking (fertile?) spores, the histogram for guard-cell length (see FIG. 7) shows an approximation to a normal distribution with a range similar to those in the parents and supports Shivas's view that the majority of individuals are first-generation hybrids. The distribution of annulus width in the hybrid shows similar features. Nevertheless, the spore fertility of the hybrid varies. One does find individuals with a higher proportion of apparently normal spores, and it is probably significant that they more closely approach *P. vulgare* in their morphology; such plants may well be back-crosses or segregants, and they deserve cytological study.

The order of increasing length of the guard-cells, *vulgare—australe —interjectum,* shows that the length is partly a basic character of, or inherited from, the various diploid species of *Polypodium,* as well as partly a mere expression of ploidy, just as spore length (which has the same order) was shown to be by Shivas. An increase, or at least not a decrease, in the size of stomata is commonly associated with higher ploidy, yet the allotetraploid *P. vulgare* has distinctly *smaller* stomata than the diploid *P. australe*. This suggests that one or both of the diploid progenitors of *P. vulgare* must have distinctly smaller stomata than *P. australe,* despite the same level of ploidy—i.e. stomata at least as small as those of *P. vulgare* itself—a point that may be of some taxonomic value in the elucidation of the diploid species. *P. interjectum* has the largest stomata of all, as one would expect in the species with the highest chromosome number. Stoma measurements for the various American diploid relatives of the group and of hybrids of them with *P. interjectum* would be most interesting.

HABITAT

P. australe is well known to be a calcicole on the Continent, and it obviously is so in Wales where almost all the stations are on highly calcareous wall mortar or limestone rock. Observations in Wales show that there is an ecological difference between *P. interjectum* and *P. vulgare*; *P. interjectum* has clearly inherited the calcicoly of the *australe* parent, whereas *P. vulgare* is a moderate calcifuge.

In the predominantly acidic country of central Wales *P. interjectum* is almost confined to, and locally common on, wall mortar; it is typically associated with *Asplenium ruta-muraria, A. trichomanes* ssp. *quadrivalens, Ceterach officinarum,* and the mosses *Encalypta streptocarpa, Barbula unguiculata* and *B. recurvirostra.* Only rarely has the writer seen *P. interjectum* off wall mortar here, and then in most cases as isolated plants that were probably strays. But in the Carboniferous limestone country of Anglesey it is abundant along roadside banks—a habitat where it apparently never grows in acidic country—and it is to be expected that *P. interjectum* is frequent in natural habitats in calcareous districts.

P. vulgare on the other hand is abundant and normally the only species in acidic habitats—dominant *Quercus petraea* woodland on base-deficient soils of the hill-country, overgrown bushy drystone walls and banks, mountain rocks, and tree trunks. It is uncommon on wall mortar, where it is pale-coloured, sickly-looking and poorly grown.

DISTRIBUTION

According to SHIVAS (1961), *P. australe* is a southern European species reaching its northern limit in the south-west of the British Isles; *P. vulgare* is a northern species which extends to the Arctic; and *P.*

interjectum is intermediate, extending as far north as the southern Baltic.

A corresponding distribution pattern is to be seen in Wales. Here *P. australe* is a local plant of lowland, mainly coastal districts, at all common only in Pembrokeshire, where DAVIS (1964–5) has had considerable success in searching for it; significantly this is the mildest part of the Principality, coming within or near the 4° C mean February minimum isotherm. *P. vulgare* is common everywhere, even in the mountainous interior; indeed it is often the only species inland. *P. interjectum* is intermediate—common on roadside walls in the mild coastal strip but rare more than about ten miles from the sea. Lack of mortared walls probably partly accounts for its absence from the acidic hill country; yet it is seldom found even on apparently suitable walls in the valleys inland.

ACKNOWLEDGMENTS

The writer would like to thank Mr R. H. Roberts for freely making available the results of his related studies, for criticising the draft of this paper, and for his encouragement; Mr T. A. W. Davis for his useful information about *Polypodium* in Pembrokeshire, and for specially collecting the material on which much of the data for *P. australe* are based; Mrs T. G. Walker (Dr M. G. Shivas) for her helpful remarks; and the Keeper of Botany at the National Museum of Wales for the loan of specimens from the Welsh National Herbarium.

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EQUISETUM: REQUEST FOR MATERIAL

Living material of *Equisetum variegatum*, *E. ramosissimum*, *E.moorei*, *E.* × *trachyodon*, and *E.* × *litorale* is required for research purposes involving experimental cultivation techniques.

Anyone who could supply small amounts of any of these species from wild habitats is invited to communicate with C. N. Page, Department of Botany, The University, Newcastle-upon-Tyne 1. Material of any foreign species of *Equisetum* would also be most welcome.

SOME OBSERVATIONS ON *POLYPODIUM AUSTRALE*

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INTRODUCTION

Three of the more distinct varieties of *Polypodium* have been recorded from the extreme north-east corner of Caernarvonshire, v.c. 49. These are var. *cambricum* (L.) Lightfoot (PENNANT 1784; LOWE 1865; HYDE & WADE 1940), var. *semilacerum* Link (HYDE & WADE 1940) and var. *serratum* (Willd.) Milde (HYDE & WADE 1940; GRIFFITH 1895). It is worth noting that all three have been found at different times at Conway, while two of them—var. *cambricum* and var. *serratum*—are also recorded from the area of Carboniferous limestone near Llandudno.

As MANTON (1950) has shown, both var. *serratum* and var. *semilacerum* usually correspond to the diploid cytotype, of which the var. *cambricum* is thought to be a sterile variety. This being so, the occurrence of these three varieties at the same locality was not unexpected. It also implied that Conway and the limestone outcrops around Llandudno were likely localities for the diploid.

Following the appearance of the papers by SHIVAS (1961), a search was made at both places. At Conway plants were found which answered in many respects to the description of *P. australe* Fée. They occurred in considerable quantity on the walls of the castle and on parts of the town walls, though a few plants grew in crevices of the highly calcareous rock on which the castle stands. A brief search around Llandudno was unsuccessful, but the presence of *P. australe* on the adjacent limestone has been confirmed recently by Mr Eirian Griffiths of Deganwy.

Examination of the specimens gathered from Conway at once presented some difficulties. While some of them seemed to answer to the description of *P. australe* fairly closely, others were not so easy to identify with certainty. These had rather longer and narrower fronds, and their pinnae were not so strongly serrated. What proved more perplexing was that in some plants the number of indurated cells in the annulus of the sporangium was frequently greater than the range of 3 to 8 found by Shivas. As the specimens had been collected in March, it was difficult to determine whether they possessed paraphyses or not. At the time it was suspected that some of these plants might be hybrids of *P. australe* with either *P. vulgare* L. or *P. interjectum* Shivas.

Pieces of rhizomes of some of these doubtful plants were brought into cultivation and more fronds were gathered from Conway later in the year. A closer study of this material yielded some interesting

results. Paraphyses were found among the young sporangia in all of them. They were also seen to be fully fertile, producing a full complement of good spores. The possibility that they were hybrids was therefore regarded as highly unlikely. Shivas has shown that the presence of paraphyses is diagnostic for *P. australe* in Europe; they do not occur in its F1 hybrids which, moreover, are apparently sterile and produce mostly empty mis-shapen spores. Gradually it became clear that these problematic plants all belonged to *P. australe*, which in Conway seemed to be much more variable than the descriptions of this species indicated. A more detailed study of the variation of some of the characters which have been used in its diagnosis was consequently made.

THE NUMBER OF INDURATED CELLS IN THE ANNULUS OF THE SPORANGIUM

Counts of the number of indurated cells in the annulus were made in random samples of sporangia obtained by scraping a few sori from each frond. The range of values differed from one plant to another. While in some plants it was only 4 to 8 and agreed closely with the results obtained by Shivas, in others the total range was from 5 to as much as 14, with a mean value around 8. This was the case, for example, in a plant whose fronds in all other respects answered to the description of var. *serratum*. But other specimens had various intermediate ranges connecting these extremes, and it was remarkable that many of them had sporangia with 9, 10 or 11 cells in the annulus. The aggregate data from the Conway specimens are shown in FIG. 1.

In view of these anomalous results further counts of the number of indurated cells in the annulus were made on specimens from various other localities. Some of them, kindly lent by the National Museum of Wales, were from widely separated places: from Glamorgan and Monmouthshire to Somerset and Wicklow. Others were obtained from about a dozen localities in south-west Wales, where *P. australe* has been detected in many places recently by the enthusiastic field-work of Mr T. A. W. Davis.

The data obtained from them show quite clearly that the Conway plants are in no way exceptional. Many of those from south-west Wales are evidently just as variable. As the histograms (FIGS. 1 & 2) show, the number of cells in the annulus has the same range in both the Conway and Cardigan samples. The counts from a single frond from a Somerset locality (FIG. 3) also correspond closely with them. The modal class in these three is identical, but it must not be assumed that this is the case in all specimens. While it is true that, whenever a representative sample of plants from any single locality was examined, the mode was usually around 6 or 7, several individual plants were encountered in which the mean number of cells in the annulus was between 8 and 9. In one of the plants from Conway the average, based on 95 sporangia,

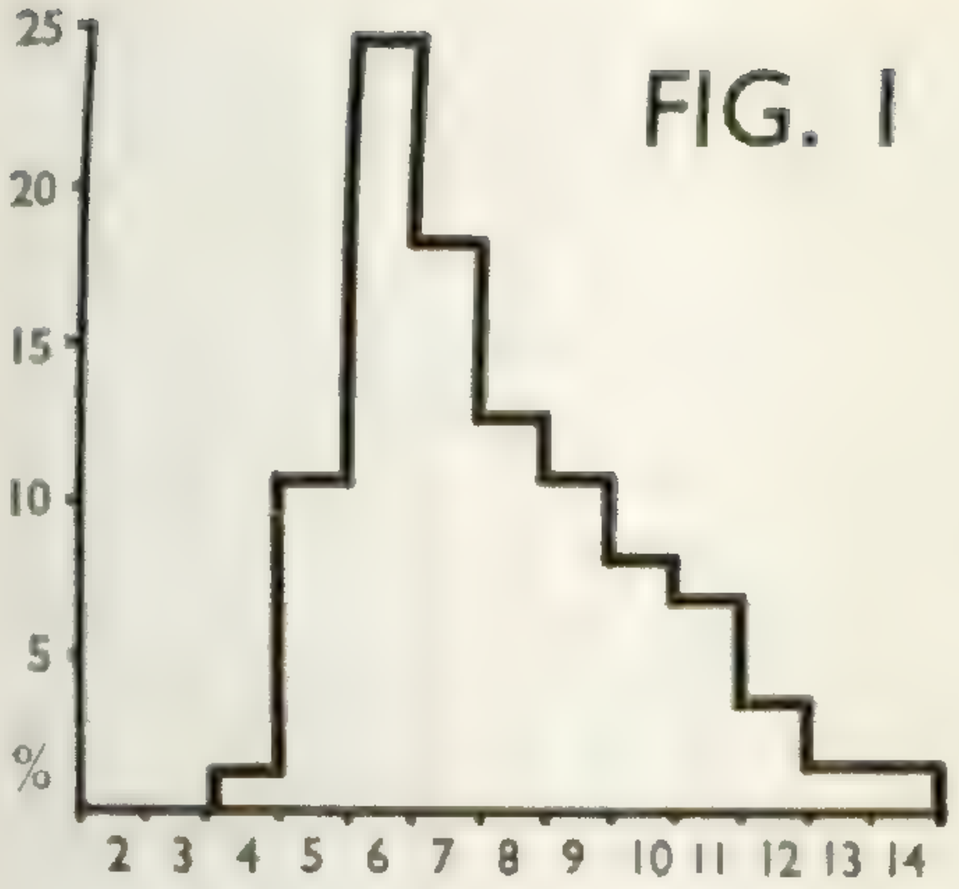

FIG. 1

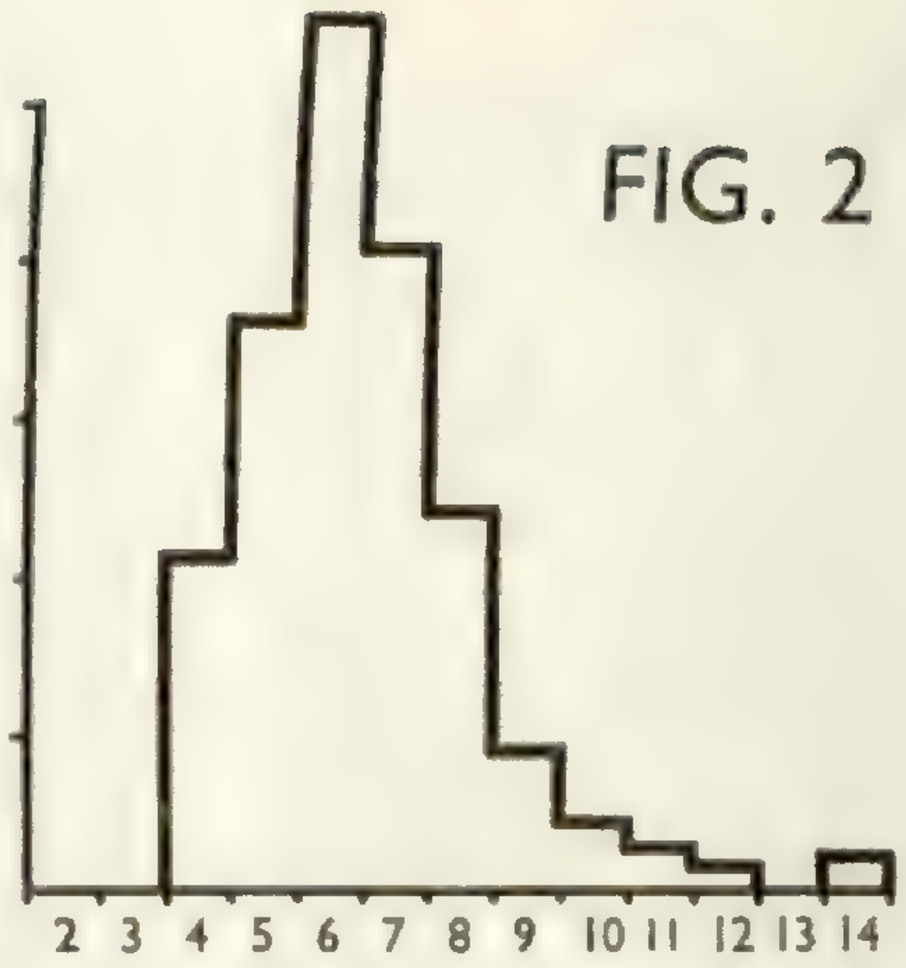

FIG. 2

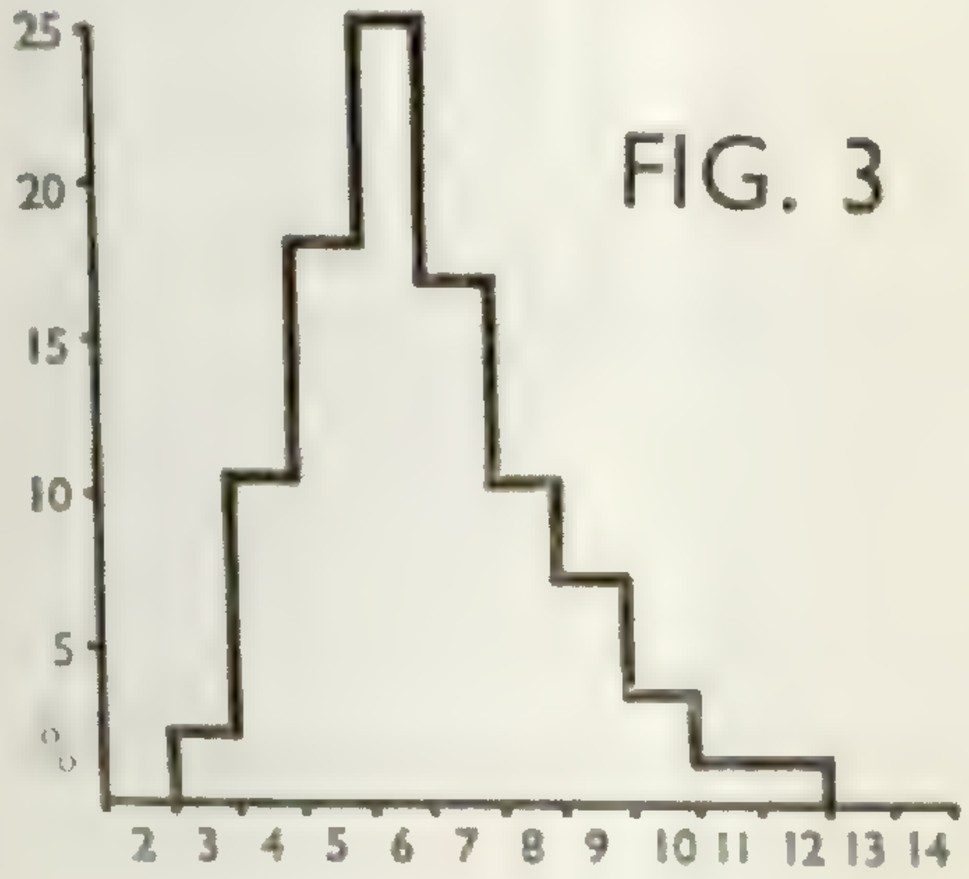

FIG. 3

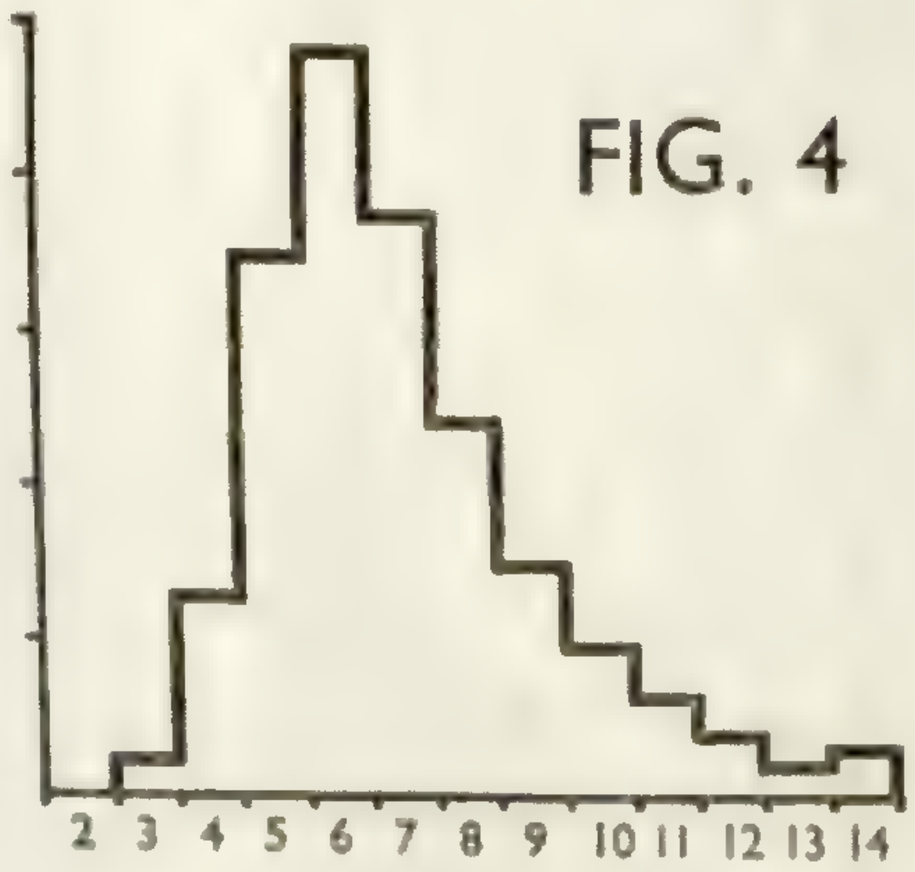

FIG. 4

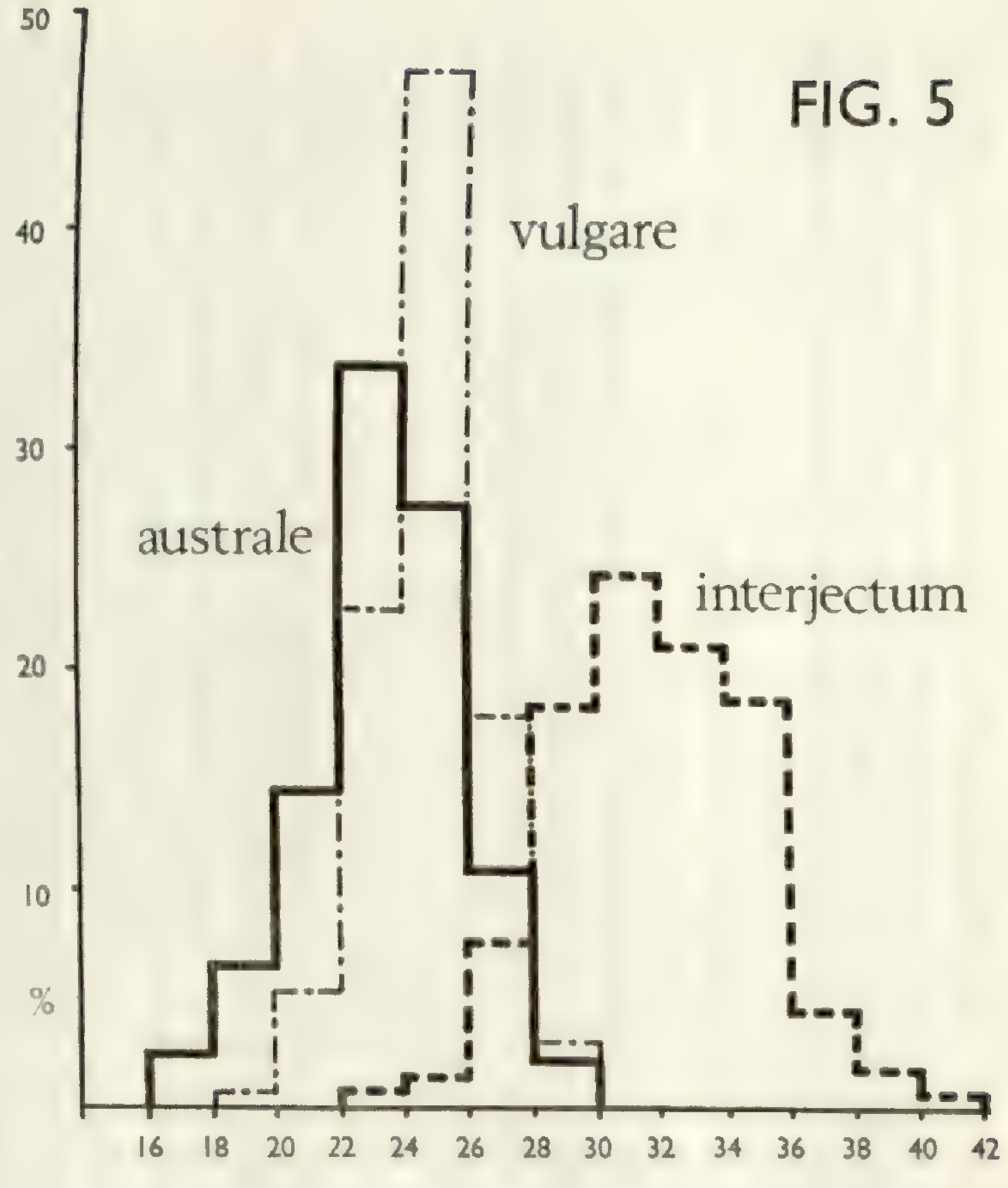

FIG. 5

NUMBER OF INDURATED CELLS

LENGTH OF INDURATED CELLS (μ)

FIGURES 1-5 Histograms of annulus characters in *Polypodium*
Number of indurated cells per annulus in *P. australe*, based on: 1) sixteen plants from Conway; 2) one plant from Cardigan; 3) a single frond from Weston-super-mare; 4) the aggregate of all samples. 5) Mean length of indurated cells per annulus in the three species of *Polypodium*.

was as high as 9·6. The overlap with *P. interjectum* is thus seen to be much greater than previous studies have indicated; the means from a few individual plants even approach the lower mean values found in *P. vulgare*. The pooled results from a total of 520 sporangia are shown in FIG. 4.

THE LENGTH OF THE INDURATED CELLS

During the course of this study the usefulness of another microscopic character became apparent. This is the size of the indurated cells of the annulus, to which attention has already been drawn by Manton. When the annulus of a dehisced sporangium is flattened by moderate pressure between two glass slides its length can be measured quite readily. The mean length of the cells in the annulus is then found by dividing this value by the number of cells it contains. Measurements of 20 annuli were made from each specimen of *P. australe, P. interjectum* and *P. vulgare* from a number of localities. The results obtained so far (FIG. 5) show that there is a considerable difference between *P. australe* and *P. interjectum* in this detail. Means based on ten annuli fall into two sharply separated groups: 21–26 μ for *P. australe,* 28–35 μ for *P. interjectum*. In practice this has proved to be one of the best means of separating these species. As BENOIT (1966) has shown, there is little difference between them in the width of the annulus. As a result the flattened annulus of *P. australe* has a more contracted look than that of *P. interjectum*. In most cases this difference is readily perceptible under the microscope, and has been found especially helpful in identifying specimens of *P. australe* with a mean number of indurated cells greater than 7. On a few occasions it has also proved useful in the determination of specimens of *P. interjectum* in which most sporangia have as few as 6 indurated cells, with a total range of only 4 to 8, thus by this character proving inseparable from *P. australe,* even when the minimum of 25 annulus counts suggested by Shivas was made.

However, the difference in this character between *P. australe* and *P. vulgare* is too small to be of use in this way, as can be seen from the histograms. But there is never the same difficulty in separating these two species, as the mean number of cells in the annulus of *P. australe* is rarely as great as in *P. vulgare*, and even then the wide difference in frond shape is sufficient to distinguish between them.

FROND SHAPE

Another character used in the diagnosis of *P. australe* is the shape of the frond. This is described as broadly ovate to triangular, and the longest pinnae are stated to be the second or third pair from the base (SHIVAS 1962). It was found in the present studies that many of the fronds did not fit this description and some were even markedly oblong-lanceolate; the longest was most often the third pair, but there were several where it was fourth, fifth or even sixth. Even so, as long as this

greater variation is borne in mind, frond shape remains a good diagnostic character of this species.

Thus, while these results suggest that the variation in British material of *P. australe* is considerably greater than was realised hitherto, its specific status is in no way affected. Increasing familiarity with it has merely served to confirm that in all respects it is a very distinct taxon.

ACKNOWLEDGMENTS

I wish to thank Mr P. M. Benoit for much useful discussion of various points, for criticism of the manuscript and for the loan of herbarium specimens; also Mr T. A. W. Davis, whose diligent field work made a wide range of material available from many new localities; and the Keeper of Botany at the National Museum of Wales for the loan of specimens.

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REVIEW

THE FERNS OF PERU: POLYPODIACEAE (DENNSTAEDTIEAE TO OLEANDREAE) [Contrib. Gray Herb. Harvard Univ. CXCIV] by Rolla Tryon; 253 pages, 16 × 24 cm; Cambridge, Mass, 1964.

There are those who on seeing a title like the above may dismiss it by saying "I shall not be collecting ferns in Peru". Such persons, however, if they have an interest in growing ferns forget they may have several species that are native to Peru and which are treated comprehensively in this book, the first part to be published of a ten-year project Keys, the most important part of any flora, are full and those to *Adiantum* (41 taxa), *Pityrogramma* (9) and *Cheilanthes* (15) are especially helpful. Dr Tryon reflects his many field collecting trips in the precise ecological data given for each species. His taxonomic observations point to many problems yet to be solved. I am glad to see he has not been tempted to treat every fern tribe as a separate family; I could not agree more with his remark "The category of family loses its utility when restricted to groups of more or less closely related genera; such groups are best treated as subfamilies or tribes".

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noted on walls several *Asplenia* — *A. adiantum-nigrum*, *A. ruta-muraria*, *A. septentrionale*, *A. trichomanes*, along with *Cystopteris fragilis*, *Phyllitis scolopendrium*, *Gymnocarpium dryopteris* and *G. robertianum*. In the ravine larger ferns were plentiful, including *Athyrium filix-femina*, several of the *Dryopteris* species including the hybrid *D.* × *tavelii*, *Pteridium aquilinum* and, most interesting of all, *Polystichum aculeatum*, *P. braunii*, and *P. setiferum* along with hybrid forms. Oak and beech ferns were abundant, as indeed they were wherever we went during the Excursion, while *Blechnum spicant* and *Polypodium vulgare* were also common.

In contrast to the sunshine on Monday, the following day dawned dull and wet, and we delayed our start till about 10.30 when the rain showed signs of abating. The weather decided some of our company to spend the day sight-seeing in Graz, and our guide led a reduced party up among the vineyards where the retaining drystone walls of the terraces were full of ferns, chiefly the smaller species, and we spent a busy time studying and photographing *Asplenium* hybrids. The species *A. adiantum-nigrum*, *A.ruta-muraria*, *A.septentrionale*, *A.trichomanes*, *A. viride* were all present, and growing happily with their parents were the hybrids *A.* × *alternifolium (septentrionale* × *trichomanes)* and a possible *A. adiantum-nigrum* × *trichomanes*. *Cystopteris fragilis* was also common in the walls.

Above the vineyards we traversed the hillside along one of the rough hill roads, and dropped down again by a sunken lane full of large ferns. A fine vigorous *D. filix-mas* with crispate pinnules was collected. The lane was the home of many salamanders, and some time was spent watching and photographing the slow-moving beautifully marked amphibians as they crawled laboriously up the banks.

Returning to the valley we followed the river back towards Deutschlandsberg, passing a large colony of *Matteuccia struthiopteris* growing in boggy ground at the water's edge. Some of the party elected to return to the town while a few of us with Herr Otto set off up the opposite hillside where in the woodland *Thelypteris limbosperma* was common and in a boggy hollow *D. carthusiana* was at home in the midst of an extensive colony of *Equisetum*. These "fern allies" were well represented in the area, and we found *E. arvense*, *E. hyemale*, *E. palustre*, *E. sylvaticum*, and *E. telmateia*. *Lycopodium clavatum* was also seen and Herr Otto was able to show us some plants of *L. complanatum*.

Later in the afternoon we said goodbye to our guide and to Deutschlandsberg and set off for our next stop, Pernegg, about 20 miles north of Graz. We joined our sightseers at Graz station, and a meal there was made memorable by delay which led to a hectic rush to catch our connecting train. Our hotel in Kirchdorf, an adjacent

THE B.P.S. AUSTRIAN EXCURSION*

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For the first time in the history of our Society, and in keeping with our wider field of interest, we ventured abroad in 1965 — to Austria — for our Annual Excursion. On Saturday 21st August, 17 members and friends assembled at Victoria Station in London to catch the boat train, looking forward to a fortnight among the Austrian mountains and the pleasure of finding new ferns. Our party included Miss S. Archer, J. W. Dyce, G. Gilbert, Mr & Mrs A. C. Jermy, Miss M. Norman, Mrs. P. Simmonds, P. Temple and W. Wright from London, H. J. Bruty, Dr F. M. Jarrett and Professor R. E. Holttum from Kew, Mrs E. M. Brightman and J. J. Brightman from Orpington, Mrs G. L. A. Craw from Dorking, P. Halligey from Lymington, and K. Trewren from Middlesbrough. In Austria we were joined by Mr & Mrs Allen from Los Barrios in South Spain, Dr. Alois Patzak from the Vienna Naturhistorisches Museum, and Professor Helmut Melzer from Judenburg in Austria.

Travelling on the Tauern Express, we reached Graz in Steiermark on Sunday evening, and from there journeyed south to Deutschlandsberg, a small pleasant town in the valley of the Lassnitz River. Here we were out of the wilder mountain area and surrounded by wooded hills, some with vineyards clothing their lower slopes, and the town was gay with colourful flower-beds and window-boxes.

On the outskirts of Deutschlandsberg the Lassnitz emerges from a deep wooded ravine full of ferns, and this was the obvious choice for our first day. By strange good fortune, as we started our hunting we met a local botanist, Heinz Otto, who is working on the ecology of the valley and has a particular interest in ferns. He joined forces with us during our two day's stay, and we would put on record our appreciative thanks for the enthusiastic help he gave us. He has a wide knowledge of the ferns of the area and their distribution, and this was put freely at our disposal so that we were able to see most, if not all, of the ferns of the district, including the rarer ones. Without his assistance we could not have hoped to achieve so much in two days.

Following the path along the river from Deutschlandsberg we

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* This describes the ANNUAL EXCURSION.
The *Newsletter* will report other MEETINGS IN 1965 viz 13 February (London SW7), 30 May (Canterbury), 3 July (Kew), 23–25 July (Ashdown Forest), 18 September (A.G.M., London SW7), 9–10 October (Farleton Knot, Humphrey Head, Kendal), 23 October (London NW3).

Amendment to heading of last year's reports

The heading "Meetings in 1965" in *Gazette* 9:239 should have read **"Meetings in 1964".**

village to Pernegg, was reached at bedtime, and next morning we were up betimes to make an early start in spite of heavy rain which fortunately did not last long.

We were now in the valley of the Mur with mountains of precipitous rock rising on the eastern bank but those on the west, although high and steep, were tree-covered and less rugged. A long pleasant walk took us into the wooded ravine valleys of those western mountains, where we split into several parties probing in different directions. The conditions were ideal for ferns, and the large-growing woodland species were abundant. Along the tracks and on the banks of their accompanying streams grew *Dryopteris filix-mas*, *D. borreri*, *D. dilatata*, *D. carthusiana*, with the hybrids *D.* × *doeppii* (*borreri* × *carthusiana*), *D.* × *tavelii* (*borreri* × *filix-mas*) and others which appeared to have even more involved parentages. *Athyrium filix-femina*, *Matteuccia struthiopteris*, *Thelypteris limbosperma*, *Pteridium aquilinum* were noted, also *Polypodium vulgare*, *Cystopteris fragilis*, and the oak and beech ferns. We also recorded *Equisetum arvense*, *E. palustre*, *E. pratense* and *E. sylvaticum*, *Selaginella helvetica* creeping happily over wet rocks, and the clubmosses *Lycopodium annotinum* and *L. clavatum*. *Gentiana asclepioides* in full bloom was common throughout the area and was greatly admired, as were colourful patches of *Cyclamen europæum* growing by the wayside.

Stiff climbing took us above the valleys with magnificent views opening out over the wooded hills. The wet morning had cleared up into a bright sunny day and the alps with their scattered chalets, perched high above in the clearings, were bathed in warm sunlight. It was a joy to rest after the labours of climbing and drink in the beauty of the peaceful scene. On the high ground many other ferns of interest were seen, including *Asplenium septentrionale*, *A. trichomanes*, and *Gymnocarpium robertianum*.

The next day was spent on the east side of the valley, and starting from the village of Mixnitz we followed the road to the Bärenschutz Waterfall. As we climbed, the road deteriorated to a track leading up the narrowing valley between high cliffs, on which we found new ferns, *Asplenium lepidum*, *A. trichomanes* subsp. *inexpectans*, and the hybrid *A.* × *javorkae* (*lepidum* × *ruta-muraria*). A large stream poured down the valley which continued to narrow till we reached an almost vertical cleft in the rock-face, down which the water cascaded in numerous waterfalls and rapids. Up this cleft our path led, and for over 600 feet we climbed by a series of step-ladders and bridges, a most amazing construction made from logs, the bracing supports driven into crevices in the rock or jammed across the narrower parts of the chasm. In places the ladders clung, seemingly precariously, to the rock-face, sometimes bathed in the spray of the waters swirling past us. It was an impressive

climb, made more interesting by the many ferns luxuriating in the humid conditions. *Athyrium* and *Dryopteris* species were abundant, with other ferns, but most exciting was *Cystopteris montana*, that very rare fern of the Scottish mountains, growing in large vigorous colonies on the wet rock-face. It was an exciting moment when we were able to admire this fern at close quarters. Above the waterfall the valley opened out into alpine meadows, with many alpine flowers and ferns, among them *Polystichum lonchitis*.

Mixnitz would make a good centre for a much longer stay, and so it was from here that on our third day in the district some of us set off up the eastern mountains once again, to the Drachenhöhle, while others had a restful day in the valley, and some explored the opposite hills where, on patches of serpentine rock, *Asplenium adulterinum* was found. The Drachenhöhle, the Dragon's Hole, an immense cavern running deep into the mountain, was reached after a steep climb through woodland and then up a rock chimney. Coming out on top of the cliffs high up the mountain-side, we had magnificent views of the valley below with the Mur River, and strung along its banks the villages Mixnitz, Pernegg and Kirchdorf. We had been joined on the previous evening by Professor Helmut Melzer from Judenburg who is working on the fern hybrids in the area, and he was able to lead us to many interesting *Asplenium* hybrids growing on the cliffs. In addition to *A. lepidum*, *A. ruta-muraria*, *A. trichomanes* subsp. *quadrivalens* and *A. viride*, we saw *A. trichomanes* subsp. *inexpectans* × *viride* (*A.* × *adulteriniforme*). *Cystopteris fragilis and C. regia, Gymnocarpium dryopteris* and *G. robertianum* were also seen.

In the morning our luggage had been left at Mixnitz Station, and from here we travelled during the evening to our next stop, Kraubath, further up the Mur valley The main attraction here was the serpentine rock with its *Asplenium* hybrids, and on the following morning (Saturday) we were off early, led by Professor Melzer. A narrow valley leads into the hills from the nearby hamlet of Chromwerk, and in a short time we were in the serpentine area. To us, accustomed to regarding *Asplenium* hybrids as rare treasures, it was an exhilarating experience to see them growing abundantly on the rocks, and in the screes and grass. The only species seen were *A. adiantum-nigrum* (often referred to as *A. forsteri*, a species of problematic status, by local botanists), *A.ruta-muraria*, *A.trichomanes* and *A.viride*, but they were outnumbered by their hybrid progeny. *A. forsteri* (v.s.), a fern of the serpentine, was common and we found a few plants of *A.* × *woynarianum*, a hybrid between *A. adiantum-nigrum* and *A. viride*. *A. adulterinum*, another fern restricted to the serpentine, was also common, but more interesting were the crosses of *adulterinum* with the subspecies of *trichomanes* and with *viride*.

After lunch we returned to the main valley and explored around a large quarry at Schaffer Hube. We found *Asplenium* hybrids here again, and in addition many flowering alpines, as well as another new fern, *Cheilanthes marantae*, growing in loose rock accumulated at the base of the cliffs. In the wooded slopes below, *A. viride* grew vigorously and a large colony of huge plants was found with bifid and trifid fronds.

Sunday was a day of rest -- spent sitting in trains as we travelled westwards and in the evening we reached Krimml, not far from the Tirol border. We had left Steiermark behind, a quiet peaceful country unspoilt by tourism and were now in a popular area where everything was much more sophisticated — and expensive. The attraction of Krimml is the magnificent Waterfall, the finest in Austria — the waters come from the glaciers above and precipitate themselves down the mountainside in three successive falls totalling about 1400 feet, a most impressive spectacle.

Needless to say, it was to the Waterfall that all our footsteps led on the following morning — a wet one, which is not to the liking of tourists so we had the place more or less to ourselves. Later when the sun came out so did all the sightseers, their attire and footwear more fitted for city streets than the rough track which zigzagged up the mountain through the woods alongside the Falls, with many viewpoints from which to admire and photograph the tumbling waters. Below lay the valley and the village of Krimml, caught occasionally in fitful sunlight forcing its way through breaks in the creeping mists. We duly admired, photographed, and were impressed by the magnificence of the scene, but there was much more of interest to us in the abundant plantlife, with ferns and their allies predominant. The conditions were ideal for these, and they flourished accordingly, giving us a very rewarding day.

It was obviously not *Asplenium* country, and only *A. viride* was noted. The Lady-fern and the common *Dryopteris* species were abundant, including the hybrid *D.* × *tavelii*, and the oak and beech ferns were everywhere. *Polypodium vulgare* was seen and we looked in vain for *P. interjectum; Matteuccia* and *Thelypteris limbosperma* were looking superficially very similar. Four *Polystichum* were there — *P. aculeatum, P. braunii, P. lonchitis* and magnificent plants of *P.* × *luerssenii (aculeatum* × *braunii). Cystopteris fragilis* was common among the huge rocks littering the mountainside and some specimens with fine attenuated pinnules were collected. Only one *Equisetum, E. sylvaticum,* was seen, also *Selaginella selaginoides* and *Lycopodium selago* and *L. annotinum.* Extensive fruiting colonies of the latter provided some good colour slides.

After our brief visit to the Krimml Waterfall we were again on our way, and left Krimml at 5 o'clock by bus, to travel by the new High Alpine Road over Gerlosplatte to Mayrhofen. This road zigzags up the mountains above Krimml in a series of hairpin bends, and in one place winds completely round passing over itself. Impressive views of the Waterfall across the valley opened out as we climbed. Darkness had fallen before we descended again steeply to Mayrhofen, so we were unable to admire the beauty of this small town in its superb mountain setting. Another bus run took us up the Zemm valley to Ginzling tucked away among the hills. From here only a rough track led steeply up the Zemmtal for about 6 miles to Breitlahner, and up this we were transported by minibus — quite a hair-raising experience — to the Breitlahner Gasthof, where we were to remain for the rest of our stay in Austria.

Breitlahner, a hamlet of only a few houses scattered over a small alp at the junction of two valleys, the Zamsertal and the Zemmtal, at an altitude of over 4000 feet, is the end of the road for wheeled traffic. From here one walks, and pack-horses are used for transport to the habitations further on. These narrow valleys between precipitous mountains run southwards into the high Tirol hills, the Zemmtal climbing for about 7 miles to the Berliner Hütte at about 6700 feet, and the Zamsertal much longer, but giving an easier climb of about 4 miles, to the Dominikus Hütte. Mountain torrents race down to meet at the junction of the valleys, and at this spot stands the Gasthof in a fine setting.

We were looking forward to four days scrambling, climbing and plant-hunting, and we started off eagerly on the Tuesday morning in fine weather, each intent on spending the day in his or her own way. In the afternoon the rain began, and continued incessantly all week till Friday morning when it suddenly stopped, the sky cleared, and we saw the sun again. This was the storm which caused so much chaos and havoc throughout the Tirol and the north of Italy, but it did not disturb us unduly apart from cramping our activities somewhat. Cascades poured over the mountain precipices and surged down the valleys. Everywhere was sodden underfoot, and there were muddy landslides over the tracks, bridges were swept away, and the occasional reverberating roar of falling cliff loosened by the rains echoed round the hills. Intermittent glimpses of the high peaks through the clouds showed them becoming whiter and whiter with fresh snows. And on the Friday afternoon, when they glistened in the sunshine against a blue sky, there were magnificent scenes to use up the colour film in our cameras.

There was much coming and going during our stay, the tougher members venturing further afield, some to climb to the Berliner Hütte

where they stayed for one night, some to the Dominikus Hütte, and others to scramble on the wet mountain slopes bringing back ferns and alpine plants. Our less energetic members, more averse to water and mud, sallied forth during the short intervals when the storm decreased in intensity. The drying-room was working overtime, full of dripping clothing and soaked boots, but our spirits remained cheerful, undamped by the weather.

Ferns were plentiful in the valleys and on the slopes, as well as alpine plants many of them still in bloom and creating a counter-attraction to the ferns. One delightful find was *Moneses uniflora*, the Single-flowered Wintergreen, which is a very rare plant of the north of Scotland. This was in flower on the rocky wooded slopes of the Zamsertal. Sheltered valley bottoms were the habitats of the larger ferns and we noted *Athyrium filix-femina*, *Dryopteris assimilis*, *D. borreri*, *D. carthusiana*, *D. dilatata*, *D. filix-mas*, *D.* × *tavelii* and several other problematic hybrids in this genus, *Matteuccia struthiopteris*, *Polystichum aculeatum*, *P. braunii*, *P.* × *luerssenii*, *Thelypteris limbosperma* and *Pteridium aquilinum*. With them were *Blechnum spicant*, *Polypodium vulgare*, *Thelypteris phegopteris* and *Gymnocarpium dryopteris*. "Fern allies" were well represented with *Equisetum arvense*, *E. palustre*, *E. pratense*, *E. sylvaticum*, *E. variegatum*, *Lycopodium annotinum*, *L. clavatum*, *L. selago* and *Selaginella selaginoides*.

Higher up grew *L. alpinum*, and another selection of ferns, the more interesting being *Asplenium* × *alternifolium*, *Botrychium lunaria*, *P. lonchitis*, *P.* × *illyricum* (*aculeatum* × *lonchitis*), *Cystopteris montana* and *Woodsia alpina*. It was most interesting to see our rare *P. lonchitis* growing abundantly on the hillsides. Only a few plants of the very handsome strong-growing hybrid, *P.* × *illyricum*, were seen. Other spleenworts noted were *A. ruta-muraria*, *A. septentrionale*, *A. trichomanes* and *A. viride*, along with *Cystopteris fragilis* and *Athyrium distentifolium*.

In spite of all the rain it was with great regret that we left this lovely spot early on Saturday morning, needless to say in brilliant sunshine, setting off down the track by minibus to Ginzling and Mayrhofen, where we caught our train en route for Innsbruck. Shopping and sight-seeing occupied the time there before boarding our train for home and in the late Sunday afternoon we were again at Victoria Station and departed on our separate ways with happy memories of a most successful Excursion.

One thing remains — to give tribute to those whose special contributions made the Excursion successful and to whom we are all greatly indebted. Particular mention must be made of the preliminary planning by Miss Anne Sleep on which our whole itinerary was based, and of the tremendous amount of work put in by Mr. Peter Halligey both

before and during the Excursion. To him is due the credit for the organisation which ensured that everything went off without a single hitch from start to finish and we are deeply grateful to him. Dr. Patzak gave us invaluable assistance and guidance which has been greatly appreciated, as was the help given by Professor Melzer whose knowledge of the ferns and in particular the hybrid forms, made our visit to the Mur valley so very rewarding.

FERN CLASSES AT SOUTHPORT FLOWER SHOW

25–27 AUGUST 1965

JUDGES' REPORT

It does not seem a year ago since W. G. Mackenzie and I were walking round the fern exhibits at Southport and as always it is a great pleasure to note the ever increasing standard of perfection the exhibitors have achieved in growing and presenting their favourite specimens. This year, through "circumstances beyond their control", one or two of the major exhibitors had not entered their usual contributions and their absence was greatly felt. On the other hand, perhaps on account of the unusually cool summer, the general appearance of the exhibits was better than ever, fronds were fresh and unblemished where in previous years I have had to mention one or two marred by weathering and premature browning of occasional fronds. How the exhibitors managed to stage their ferns with so small an amount of damage was a great surprise in view of the conditions : a strong gale was blowing, one or two marquees actually were blown down, the side canvas was billowing uncontrollably, the roof canvas was whipping and cracking as though it would split asunder any second. The noise was nerve racking, yet the following morning all was well, the ferns stood serene and beautiful as though nothing had happened.

Noel Brookfield showed his usual ground group full of first class varieties. All the classes were entered, one or two very strongly, giving the judges some close pointing and much deliberation before making the awards. In the greenhouse ferns I noted a fine pan of *Phymatodes diversifolia* — this grows very freely in the open up the trunks of palm trees at Logan — and there were good examples of *Davallia* and *Platycerium*. The superb specimen of *Adiantum* 'Kensington Gem' shown by Bernard Hayhurst was better than ever. One gets to recognise some of the exhibits as old friends. Such fine specimens should do much to stimulate public interest in our hobby and encourage new exhibitors to try their luck.!

The British Pteridological Society is indebted to the Southport Show Committee for providing such a comprehensive set of classes for British ferns and the judges would like to see even more members coming forward as exhibitors at future shows.

R. KAYE

Waithman Nurseries, Silverdale, Lancs.

PRIZEWINNERS AND THEIR ENTRIES

CLASS 8 A group of hardy British ferns, with accent on diversity and variation, arranged in a natural manner in a space 13 feet by 8 feet and not higher than 6 feet above the ground:

1st Messrs. J. Brookfield & Son who continue to hold the Silver Perpetual Challenge Trophy presented by the British Pteridological Society.

CLASS 9 Six dissimilar hardy British ferns with accent on variation:

1st Messrs. Brookfield: *Athyrium filix-femina* 'Capitatum', *A.f.* 'Pritchardii', *A.f.* 'Plumosum Superbum Druery', *Phyllitis scolopendrium* 'Crispa', *Polypodium vulgare* 'Hadwinii', *Polystichum aculeatum* 'Gracillimum'.

2nd J. Pye: *Athyrium filix-femina* 'Capitatum', *A.f.* 'Cruciatum', *Dryopteris filix-mas*, 'Cristata', *Polystichum setiferum* 'Conspicuilobum', *P.s.* 'Cristatum', *P.s.* 'Divisilobum'.

3rd B. Hayhurst: *Athyrium filix-femina* 'Cruciatum', *Dryopteris dilatata* 'Succisa', *Osmunda regalis* 'Cristata', *Phyllitis scolopendrium* 'Ramo-marginata', *Polypodium vulgare* 'Pulcherrimum', *Polystichum setiferum* 'Divisilobum'.

CLASS 10 Three distinct varieties of *Phyllitis scolopendrium*:

1st Messrs Brookfield: 'Marginata', 'Crispa', 'Cristata'.

2nd B. Hayhurst: 'Albo-variegata', 'Crispa', 'Ramo-cristata'.

3rd N. H. Almond: 'Drummondiae', 'Ramo-cristata', 'Ramo-cristata' (dwarf form).

CLASS 11 Three distinct varieties of *Polypodium vulgare*:

1st Messrs. Brookfield: 'Cristatum', 'Oxford', 'Pulcherrimum'.

2nd B. Hayhurst: 'Grandiceps Cowan', 'Hadwinii', 'Pulcherrimum'.

CLASS 12 Three distinct varieties of *Polystichum*:

1st B. Hayhurst: *P. setiferum* 'Divisilobum Densum', *P.s.* 'Divisilobum Iveryanum', *P.s.* 'Imbricatum Cristatum'.

2nd N. Robinson: *P. aculeatum* 'Pulcherrimum Bevis', *P. setiferum* 'Divisilobum Grandiceps Jones', *P.s.* 'Divisilobum Iveryanum'.

3rd Messrs. Brookfield: *P.aculeatum* 'Gracillimum', *P.a.* 'Pulcherrimum Bevis', *P. setiferum* 'Acutilobum'.

CLASS 13 Three distinct varieties of *Athyrium filix-femina*:

1st B. Hayhurst: 'Cruciatum Cristatum', 'Percristatum', 'Victoriae'.

2nd N. H. Almond: Cruciatum', 'Frizelliae Capitatum', 'Victoriae'.

3rd N. Robinson: 'Cruciatum Angustatum', 'Gemmatum', 'Victoriae'.

CLASS 14 Three distinct varieties or species of *Dryopteris* (including *Gymnocarpium* and *Thelypteris*); all exhibits, except Brookfield's marsh-fern, were *Dryopteris*:

1st B Hayhurst: *D. borreri* 'Angustata Cristata', *D. dilatata* 'Succisa', *D. filix-mas* 'Depauperata Cristata'.

2nd N. Robinson: *D. filix-mas* 'Lineata Cristata', *D.f.* 'Martindale', *D.f.* 'Ramosissima'.

3rd Messrs Brookfield: *D.borreri* 'The King', *D.filix-mas* 'Cristata', *Thelypteris palustris.*

CLASS 15 Three distinct varieties or species of *Asplenium*:

1st Messrs Brookfield: *A. adiantum-nigrum, A. ruta-muraria, A. trichomanes.*

CLASS 16 Three distinct normal species of hardy British ferns:

1st N. Robinson: *Blechnum spicant, Polypodium vulgare, Polystichum setiferum.*

2nd Messrs. Brookfield: *Adiantum capillus-veneris, Blechnum spicant. Gymnocarpium dryopteris.*

CLASS 17 One British fern of any kind or variety:
1st B. Hayhurst: *Athyrium filix-femina* 'Gracillimum'.
2nd Messrs Brookfield: *A.f.* 'Plumosum Superbum Druery'.
3rd N. H. Almond: *A.f.* 'Cristatum'.
4th J. Pye: *A.f.* 'Victoriae'.

CLASS 18 Six dissimilar greenhouse ferns:
1st B. Hayhurst: *Adiantum* 'Kensington Gem', *Adiantum cuneatum*, *Davallia canariensis*, *Phymatodes diversifolia*, *Nephrolepis exaltata*, *Platycerium alcicorne*.
2nd Messrs Brookfield: *Adiantum* 'Kensington Gem', *Davallia canariensis*, *Nephrolepis* 'Cristata', *Nephrolepis exaltata*, *Platycerium alcicorne*, *Polypodium aureum* var. *areolatum*.

CLASS 19 Three dissimilar greenhouse ferns:
1st Messrs Brookfield: *Adiantum* 'Kensington Gem', *Davallia canariensis*, *Nephrolepis exaltata*.
2nd B. Hayhurst: *Adiantum* 'Kensington Gem', *Davallia bullata*, *Nephrolepis* 'Rosea'.

CLASS 20 One greenhouse fern:
1st B. Hayhurst: *Adiantum* 'Kensington Gem'.
2nd M. Plowman: *Adiantum* 'Fritz Luthi'.
3rd W. W. Howarth: *Adiantum* 'Fragrans'.

27 Yewlands Drive, Fulwood, Lancs. N. ROBINSON

A VISIT TO FERNDENE, KENDAL

During a Northern Weekend Meeting of the British Pteridological Society in October 1965 I suggested a visit to the former garden of Joseph Wiper* to see what remained of his ferns. The first meeting convened amongst the Lakeland fern enthusiasts to form our Society was held in Joseph Wiper's shop. He had a magnificent collection of ferns in those days but sold many of them from time to time, and finally emigrated to Canada in 1911. his garden being taken over by Mr Monkhouse a bulldog breeder but also interested in the ferns. Joseph took specimens of his ferns to Canada and soon established a collection in Victoria B.C. After Joseph's death his ferns were taken to Vancouver by his son Ernest*; later, his grandson Kenneth G. Wiper (son of George who died in June 1964) formed another fern garden on Vancouver Island assisted by spores and plants from the old collection. The Wiper gardens created epicentres of the fern cult visited by fern growers from all parts, particularly Canada and U.S.A.

* JOSEPH WIPER born Kendal 25 September 1848 died Victoria B.C. 11 February 1930 leaving three sons (Ernest; George; John aged 98 living in Alberta) and two daughters. Charter member of the Vancouver Alpine & Primula Society, the Primula Society of America, the American Fern Society. Founder member 1891 of the British Pteridological Society. Fern finds: Athyrium filix-femina 'Caudigerum', Thelypteris limbosperma 'Filifera' and 'Gracilis'. Obituary in *Brit. Fern Gaz.* 6:33 (1930). Portrait in two group photographs in *Brit. Pterid. Soc. Papers Meeting* 1899.

* ERNEST WIPER born Kendal 26 September 1879 died Vancouver B.C. 18 March 1964 leaving two sons (Joe and Theo). Member 1909 of the British Pteridological Society.

The Wiper family, who made Kendal Mint Cake a famous confection still in great demand by mountaineers as a concentrated food, started another wholesale and retail manufacturing confectionery business in Victoria and when Joseph died transferred to Vancouver where it is still carried on by two grandsons Joe and Theo (sons of Ernest).—I well remember meeting Ernest when he visited Southport Flower Show many years ago; he and his wife used to make many collecting trips into the Victoria mountains, and on three occasions lost their bearings and had to spend the night couched on cedar boughs among sheltering rocks till daylight made progress safe.

The garden at Ferndene (formerly Fern Deane) has changed hands many times. I visited it ten years ago and saw many fine things still happy there, but in the meantime some landscape work has been done, a new garage introduced, and some of the old fern beds have gone. Mr Ingham the present owner was very interested in hearing about the history of the garden and although he knew little about the ferns is going to preserve what are there and inform me if he considers leaving, so that provision may be made to ensure the safety of the remaining specimens. The first plants just within the gateway were several *Dryopteris filix-mas* 'Barnesii' and we noticed several self-sown seedlings established in the wall. Several good forms of *Polystichum setiferum* 'Divisilobum' were the next finds, growing more or less happily below some bushes. Towards the house the sloping ground had been terraced with limestone dry walls and in these were several varieties of crested athyriums, some good, some obviously self-sown and of little account. Large clumps of *Dryopteris filix-mas* 'Grandiceps Wills' were noticed here. A large bush of *Dryopteris filix-mas* 'Bollandiae' showing good autumn colour was fighting it out with ivy and tree roots in one corner. *Dryopteris borreri* 'Crispa' in large clumps was growing at the base of another wall. A stream trickling through an old rock-garden was lined with many ferns, a large clump of crested royal fern, more 'Bollandiae', and many polystichums were flourishing. A seedling on the lines of *Polystichum setiferum* 'Cristatum Wollaston' but with ovate pinnules was rather striking and at the owner's suggestion was taken by Fred Jackson for safe keeping. *Polystichum aculeatum* 'Acutilobum' was represented by two or three large clumps, and some rather good plumose athyriums also were noted. The most striking find was a large mass of *Pteridium aquilinum* 'Cristatum', several square yards in extent, a very good form indeed with every pinna terminating in a fine crest, perfectly symmetrical. Plants and spores were given to Fred Jackson and myself.

There are many gardens in the district where the old fern men grew their treasures, but on the deaths of their owners these collections were dispersed by gift or sale and most of the plants lost. It was a

great pleasure therefore to find just a part of Joseph Wiper's original collection still surviving and even thriving, sixty years after he had left it in other hands. There must be many plants still to be found in other gardens, whose present owners have acquired them with the houses of former fern enthusiasts long passed away, plants which may be the last examples of varieties believed lost to cultivation.

Waithmam Nurseries, Silverdale, Lancs. REGINALD KAYE

REVIEW

SPORES · FERNS, MICROSCOPIC ILLUSIONS ANALYZED Volume One by Clara S. Hires; xxiv + 548 pages, 1150 illustrations, 8½ × 11 inches; Millburn, New Jersey: Mistaire Laboratories, June 1965; price $22.50.

This volume, entitled *VARIED PLANT GROUPS INTRODUCE TRUE FERNS THROUGH SPORE TETRAD STRUCTURE*, is the first of "future volumes restricted to ferns" to prove the value of three-dimensional spore study, and designed to help a diversity of professions from artist to zoologist ranging through botanist, criminologist, doctor, evolutionist, food analyst, etc.

The 1150 illustrations comprise about 700 drawings, 100 photographs, 336 photomicrographs in black-and-white and 14 photomicrographs in colour. The first quarter of the book is concerned with understanding the architecture of spores, emphasizing their solid geometry by means of such aids as three-dimensional models and microscopy. Scattered through the book are various reference guides (such as lists of persons, books, terms, etc.), various technical guides (concerning mounting media, mathematics, photomicrography, etc.), and historical information about the author and the 38-year-old Mistaire Laboratories. The main part of the volume presents a collection of photomicrographs of spores which, apart from accompanying explanatory text, speak for themselves and form a valuable source of reference.

However, there are three things which would have greatly enhanced the usefulness of this book : (1) an alphabetical index to figures of plants, giving page references to each species and to parts (frond, indusium, spore, etc.), placed at the *end* (*not* as "Contents" on page iv or "Mistaire ferns . . . used for research" on page 477, which I found elusive and exasperating), (2) a check on the authority of the plant names, by giving the source of each picture which should preferably have been taken from a herbarium specimen available for reference, (3) a better selection of pictures displayed uniformly for easier comparison, particularly as there is a varied amount of material presented, e.g. *Dryopteris marginalis* occupies thirty-two pages and *Polypodium vulgare* three.

Nevertheless the author is to be congratulated for a valuable

contribution beautifully set with very clear type and illustrations. Her enthusiasm was further shown when she issued with this first volume two Mistaire Awards of one-hundred dollars each, one "to the person contributing the most helpful, constructive criticism of my basic spore concepts", and one "to the first person who can honestly prove . . . that my basic spore concept . . . is incorrect". In 1965 she published a Supplement consisting of a summary of her basic theories and a reprinting of ten plates "to provide better orientation and larger backgrounds to insure clearer outlines." We look forward with great interest to the promised further volumes.

British Museum (Natural History), London SW7 JAMES A. CRABBE

REVIEW

LEARN OF FERNS WE GROW by Sylvia B. Leatherman and Dorothy S. Behrends, [xii] + 166 pages, 15 × 22cm, 35 line-drawings by Mrs Behrends; Los Angeles, published by the authors, May 1965; price $3.85 ($4 postage paid) from B & L Books Dept. A, 2637 North Lee Avenue, South El Monte, California 91733.

The authors of this attractively designed stencil-produced ring-bound book are well known in Californian and other horticultural circles. Although based on experiences in the warmer areas of California, it is full of useful hints and ideas for the use of fern growers everywhere. Written with a conviction that sometimes assumes an air of dogmatism, it is the result of personal trials and errors, and one must bear in mind that what happens in California may not necessarily be the case in a different climate. Chapter 16 on pests describes the authors' encounters and remedies in their area, but is nevertheless a good general guide. Osmunda regalis spores (p.124) are "reported not to be viable after 30 days", whereas it is doubtful whether 3-day-old spores would germinate; the name of an organ and its plural form is often confused (p. 112, etc). with consequent disagreement in verb inflexion; it is suggested (p.114) that one can see the maturation of the gametophyte (prothallium) "on fruiting fronds"; a glossary (p.C.) should obviate defining terms throughout the text; "rounded objects on minute-like stems . . . like little lollypops" (p.115) presumably refers to sporangia, not spores; the gametophyte is described "simply and briefly" (pp. 112, 129, etc.), but the result is confusing and sometimes misleading, e.g. "antherida and archegonia . . . move about freely, perhaps even swim" (p.130); a cultivar is any assemblage of cultivated individuals which propagates true-to-type and is not necessarily "a hybrid" (p.132).

My review copy is dated "First printing, May 1965" and I hope this first edition will soon be revised and the botanical inaccuracies corrected. Some system of quicker reference to the many useful and interesting points would be a blessing. The text in capital letters is not acceptable to everyone, but the authors presumably had a reason for using this unusual typography.

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FERN HYBRIDISTS AND FERN HYBRIDISING
I. THE WORK OF EDWARD JOSEPH LOWE (1825-1900)

JOHN D. LOVIS
Department of Botany, Leeds University

Both this paper and its companion owe their origin not to an inspiration of my own, but instead to a suggestion from Mr J. A. Crabbe, who informed me that as a result of discussion on the subject of fern hybrids at the Brantwood meeting of the Society, it was clear to him that an account of the methods used by the Leeds group in hybridising ferns would be welcomed by readers of the Gazette. Furthermore, an assessment of the work of E. J. LOWE, as described in his book ' Fern Growing ' (1895),* and in particular, of his theory of " multiple parentage ", would also be of interest. It soon became evident to me that it would be difficult to combine these two topics satisfactorily within one article, with the consequence that in the end I have not attempted to do so, but intend to treat them separately. This article, which is solely concerned with the work of Edward Lowe, is presented first.

I must confess at the outset that when this project was first suggested to me, I was totally ignorant of this particular book, ' Fern Growing ', by Lowe, and in writing this article I have assumed that at least some of my readers will be as ill-informed in this respect as I was myself. I expect that given the opportunity most readers of the Gazette would find Lowe's account of his own work as interesting as I have done, but unfortunately this book seems to be rather rare, and indeed is described in the trade as ' scarce '. No copy was available in Leeds, and I am very grateful indeed to Mr J. W. Dyce for the protracted and generous loan of his own personal copy, without which I could not have made my analysis.

To a very great extent, this book consists of a summary of Lowe's own work as a fern hybridist. A considerable proportion of the first part of the book takes the form of direct quotations from Lowe's earlier publications on this subject (see references at end of paper), although the experiments concerned are described anew in the later part of the book. There is indeed a considerable degree of repetition. Certain experiments are described no less than three times, and a close comparison will occasionally reveal minor inconsistences with regard to detail, most obviously with regard to dates.

It is at once apparent that Lowe was a pioneer in this field of study, and like many other pioneers in science, he had to struggle for recognition for a great many years against an adverse climate of opinion. Thus he had to campaign for an unconscionable length of time to gain

*All page references given in the text of this article refer to this publication.

The BRITISH FERN GAZETTE Volume 9 Part 7 was published on 24 June 1966

acceptance of an idea (that ferns can cross and produce hybrids), which we today accept without question as undoubtedly correct.* On the other hand, latterly he persisted with equal passion in support of a concept, that of multiple parentage, which we today must regard as ill-founded, since basic to Lowe's ideas was his belief that the union of one spermatozoid and one ovum is never alone sufficient to produce a sporophyte.

One is surprised and intrigued to learn what difficulty Lowe had in convincing the botanists of his day that indeed it was possible for ferns to hybridise. Furthermore, one is astonished to discover that as late as 1884, a paper submitted to the Linnean Society describing one of his hybridisation experiments was rejected, and returned to him as " not proved " (p. 63), a decision which clearly deeply wounded and permanently offended poor Lowe. (Some of us have reason to be thankful that the Fellows of the Linnean Society are today no longer so sceptical concerning fern hybrids!). This is all the more remarkable in view of the relative sophistication of the experiment being reported, which is indeed of such interest as to merit description in some detail here.

We may first note that like all of Lowe's hybridisation experiments, the hybridisation was attempted by the simple device of making a dense sowing of spores from the intended parents together in the one pot, followed by examination and classification of a large progeny. It is difficult to improve on Lowe's own words (p. 80):

" In 1875 the spores of *Aspidium angulare* var. *Wakelyanum* (a narrow strap-shaped cruciate variety) and *Aspidium aculeatum* var. *densum* (a short fronded form with crowded pinnae) were sown together to produce a hybrid. It was thought that if a cruciate *Aspidium aculeatum* could be obtained, this would be a convincing proof that the cross had been acquired, as previously a cruciate variety of *Aspidium aculeatum* was unknown. These plants came to maturity in 1882; the number of seedlings slightly exceeded 1000, but all except five were close copies of *Aspidium aculeatum* var. *densum*, or of *Aspidium angulare* var. *Wakelyanum*; these five hybrids had all the characters of *Aspidium aculeatum* (in the stronger consistency of the pinnae, and richer and deeper colour), but not only this, they were a copy of the cruciate variety *Wakelyanum*."

The successful crossing of two species is clearly a more effective demonstration of hybridisation than a cross between two varieties, but in this respect Lowe, as he points out (p. 13), encountered the difficulty

*The majority of botanists in the middle of the 19th century appear to have believed it, to quote Lowe (p.11) " quite impossible for the male organs from one prothallus to impregnate another ". It does however appear that Lowe did not entirely lack support. A. M. Jones (*Gard. Chron.* ser. III. 3:426, 457–9. 1888) shares " . . . the credit of having been the first to recognise the fact of the crossing of Ferns . . . " equally between Lowe and four others (J. M. Barnes, J. E. Mapplebeck, J. Moly, and Stansfield the elder), whom he states had formed " . . . independent conclusions . . . , nearly about the same time, . . . ", though no dates or references are quoted. I am indebted to Mr Crabbe for drawing my attention to the existence of this article, which provides a valuable perspective to the account given by Lowe of the activities of his contemporaries.

that many botanists were at that time still unconvinced regarding the specific distinctness of *Polystichum aculeatum* and *P. setiferum*.* Lowe clearly anticipated (p. 13), that an inter-specific hybrid could be expected to be sterile, and he did evidently take extreme pains to demonstrate the sterility of the spores produced by his *setiferum* (*angulare*) × *aculeatum* hybrids. Over a period of ten years he himself sowed one hundred pans without result, and he also induced various of his friends to make the attempt, most of whom experienced the same completely negative result.† Lowe further informs us that this hybridisation experiment was later repeated successfully not only by himself (p. 80), but also by E. F. Fox and Colonel A. M. Jones (p. 31).

I can see no reason to doubt the genuine success of Lowe's experiment. To the best of my knowledge, this is then the first known successful artificial synthesis of an inter-specific fern hybrid, and as such it is a remarkable anticipation, by some sixty years, of the *Polystichum aculeatum* × *setiferum* hybrids synthesised by MANTON (1950), although the modern hybrids were produced for a totally different reason, as will be shown in a later paper.

In order to understand the extent of Lowe's achievement, and equally to comprehend the reasons for his mistakes, it is necessary to consider his work in its historical context. The date of his first experiments on the mixed sowing of spores from pairs of fern varieties is variously stated by him to be 1851 (p. 12), and 1855 (p. 25). Whichever date is correct, in all conscience the date of commencement must be regarded as very early, in view of the fact that the presence of female sex organs on fern prothalli was not discovered until 1848 by Lesczyc-Suminsky. Previously, in 1844, Nägeli had seen spermatozoids released from a fern prothallus. In 1849 Hofmeister provided an integrated account of the function of the gametophyte in pteridophytes, based on his own observations of sexual biology in *Pilularia*, *Salvinia*, and *Selaginella*. His conclusions were confirmed for more typical fern gametophytes by Henfrey in 1851. (The source of this historical data is SACHS (1890) pp. 436–444.) Furthermore the entire span of Lowe's work lies previous to the rediscovery of Mendelian heredity (1900), the discovery of the reduction division (1895), and the first effective formulation of the chromosome theory of heredity (1902).

It was the firm establishment of the chromosome theory of heredity which finally established beyond any doubt that the act of

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**Polystichum aculeatum* = *Aspidium aculeatum*: *P. setiferum* = *A. angulare*. Is there in this a partial explanation for the rejection of Lowe's experiment by the Linnean Society? The genuineness of the distinction between *Polysticum aculeatum* and *P. setiferum* was crucial to his experiment. Were the specimens he sent (p. 63), in support of his paper dried or fresh fronds? At this distance of time, there is no way of finally settling this point, but it is likely that the fronds were in fact dried specimens. The characters distinguishing these two species are never so clear in pressed specimens as they are in the living plants. What was clear enough in Lowe's ferneries at Shirenewton Hall may have been less than obvious in the rooms of the Linnean Society.

†However, A. M. Jones (*Gard. Chron.* ser. III. 3:458. 1888) specifically states that the example given to him by Lowe was not barren, " . . . for it has been proved by myself and others to be easy of reproduction from spores."

fertilisation consists of the fusion of one ovum with a single sperm. Thus we know that cells in the sporophytes of *Asplenium viride*, for example, all have 72 chromosomes, but these sporophytes produce, by means of a reduction division, spores with 36 chromosomes. These spores germinate to give rise to gametophytes (the cells of which contain 36 chromosomes), which produce spermatozoids and ova which themselves have the gametophytic number of 36 chromosomes. The resultant next generation of sporophytes once again have 72 chromosomes in their cells, not 108, 144, or more, as would happen if two, three, or more spermatozoids participated in the fertilisation of a single egg. This alternation of stable chromosome numbers, 72—36—72, is consistently maintained through an indefinite number of life-cycles, thus demonstrating that multiple fertilisation has no place in the normal pattern of life. Although this type of proof was not available in Lowe's time, nevertheless the general principle of one egg, one sperm was already accepted. However, Lowe (p. 70), writes " May we not think the established law *that only one sperm acts on the same germ* does not hold good with ferns, . . . " (his italics). Why should Lowe have suggested that the ferns were an exception to this rule? The answer lies in his own experimental work. Lowe had in many of his hybridisation experiments sown together not just two parent forms, but three, four, or more, and even eight on one occasion (p. 84), all in the same pan. He had become convinced, on examination of the progenies of certain of these experiments, that the morphology of some of the hybrids he produced could only be explained if more than two parents had participated in their production. In other words, these plants were of multiple, rather than dual, parentage.

From this point on, the argument becomes more complex, because the outcome of some of his experiments led Lowe to suggest that multiple parentage might not necessarily originate by the more obvious means of the multiple fertilisation of a single ovum by two or more spermatozoids, but instead through several independent fertilisations of one gametophyte either contributing to the production of a single sporophyte, or resulting through reciprocal influence in the production of two or more sporophytes of identical morphology. This fusing or mingling effect Lowe termed " assimilation ". Lowe proposed this hypothesis because he could conceive of no other way of explaining the outcome of certain hybridisation experiments wherein he obtained several examples of the same unique and novel variety from one prothallus (pp. 37, 64, 84, 102, 115–116). There is no doubt that Lowe was entirely mistaken in his interpretation, for although one prothallus can certainly sometimes sustain more than one simultaneous fertilisation and successfully produce two or more sporophytes (this has occurred many times in my own hybridisation experiments on *Asplenium*), the heredity of these sporophytes is independent. How then can these particular results obtained by Lowe be explained? The production of several sporophytes of one distinctive form by a single prothallus can be interpreted as the consequence of the behaviour of a single genetically unbalanced hybrid zygote in having produced

more than one shoot apex before being able to achieve sufficient co-ordination for the production of fronds. Behaviour of this kind has been observed on occasion at Leeds, as the result of hybridisation between genetically sub-compatible parents.* In this respect it is significant that concerning var. 'Oenone', (one of the forms in question), Lowe comments (p. 102), that it "... has taken longer (i.e. five years) to develop than in most cases."

The concept of multiple fertilisation as the normal process in ferns is totally incompatible with modern knowledge, but the possibility that on *rare* occasions, more than one spermatozoid can take part in the fertilisation of a single fern ovum does not deserve to be dismissed with ridicule, or without proper consideration, however much one instinctively does not believe in it.

Although one might expect that the volume of chromosome studies now available would enable us to exclude, at least as a practical consideration of any significance, the possibility of the rare occurrence of successful multiple fertilisations, curiously this is not in fact so. Of course, in any hybridisation between parents of known chromosome number, the chromosome number of the progeny is predictable, but it does happen that on rare occasions, prediction is not borne out. The most striking example known to me of a hybrid sporophyte of unexpected chromosome number is a synthetic × *Asplenophyllitis* hybrid obtained by Dr Janet Emmott (now Mrs Souter), between *Asplenium obovatum* (diploid) female parent, and *Phyllitis scolopendrium* var. *americana* (tetraploid) male parent, which proved to be tetraploid, and not triploid as expected (EMMOTT 1964). The origin of this plant must be attributed to the participation of an abnormal gamete produced without reduction of the sporophytic chromosome number, since it is the contribution of the female parent that is present in duplicate. We would prefer to interpret the origin of other examples of hybrid progeny of unexpectedly high grade of polyploidy in the same way. In cases where the exceptional contribution comes from the male parent (Dr Tony Braithwaite has encountered several such examples in the course of his experimental studies (as yet unpublished), on the African *Asplenium aethiopicum* complex), it would be equally possible to regard such plants as arising by means of a double fertilisation.

Certain of the experiments carried out by Lowe which he believed demonstrated multiple parentage are of complex character, but nevertheless in view of their date these can scarcely be fairly criticised in their design, but rather for the interpretation of the results. The largest series of experiments described (pp. 30, 87, 92–96, 117–119), started in 1888, concerns four varieties of *Phyllitis scolopendrium*, namely 'Undulatum' with a wavy frond, 'Spirale', a dwarf form with a spiral apex, 'Muricatum' with muricate or blistered fronds, and 'Keratoides', a branching, crested form. These four varieties were sown together in the one pan. Parallel controls established at the same time included pans sown with each variety singly (series A), in all possible combina-

*Teste Dr A. Braithwaite (*Asplenium aethiopicum* complex).

tions of pairs, (series B–G), and all combinations of three varieties (series H–K).

Lowe reports that the progeny of three of the four pans in series A were " exactly like " the parent. The ' Keratoides ' pan " varied slightly " between ' Keratoides ' and its parent, ' Victoriae '. In the case of series B–G, at least a thousand plants were raised, " all combinations of those sown in the same pan, and no single one was exactly like either of the parents ". If Lowe's assessment of the nature of the progenies from series B–G is accepted at its face value, it is a little difficult to understand, since in progenies totalling a thousand plants obtained in this way, one would expect *some* prothalli to be fertilised by spermatozoids of the same variety. However, in hybridisation experiments conducted simply by dense sowing of mixed spores, the progeny obtained will not be a random sample of the fertilisations that occur, but instead will be influenced by the effects of competition. Hybrid sporophytes are very frequently more vigorous than those of either parent. The effect of the interaction of competition and hybrid vigour may well have distorted the composition of the progenies actually raised by Lowe, so that they did not in fact represent the proportions of fertilisations occurring in the population of prothalli grown in the pan.

The crucial pan is that one which contained prothalli of all four varieties. Lowe claims that out of a progeny of between two and three hundred plants, four plants " unmistakably show the character of all the four parents ". Fronds from these four plants, and the four parent varieties are all illustrated. How should we interpret these experiments? It is easier to arrive at a confident conclusion if we concentrate our attention on another similar but simpler experiment (pp. 99–102), involving the mixed sowing of three varieties of *Phyllitis*, namely ' Khedive ', ' Rosabelle ', and ' Corale '. Concerning the progeny, Lowe writes of one plant, which he named ' Desirée ', that it " conclusively shows the projections of ' Khedive ', the crispate character of ' Corale ', and the fimbriated margin of ' Rosabelle '." (p. 100). He continues, " None of the experiments show multiple parentage more plainly than this ". In view of this last statement, it is reasonable to regard ' Desirée ' as critical for evaluation of Lowe's claim to have obtained evidence of multiple parentage. Furthermore, this is the only experiment where we are provided with *photographic* illustrations of both the hybrid and its postulated parents. It is evident to me that Lowe was clearly mistaken in his interpretation of the origin of 'Desirée', which might readily be obtained from the cross ' Khedive ' × ' Rosabelle ', and indeed appears to be a more or less perfect intermediate between these varieties.

My candid assessment of the limited evidence available to us is that in his anxiety to obtain his desired evidence, Lowe unwittingly permitted his enthusiasm to dull his faculty for objective judgment, for it is clear in the case of ' Desirée ', that the fronds illustrated do not justify the claim made. Therefore, and regretfully, Lowe's assessment of his own progenies must be regarded as suspect. Undoubtedly, he

raised some extraordinary hybrid forms. Without our modern knowledge of the immense power of genetic recombination, it is not really surprising that he came to believe that some of the remarkable plants he raised can only have originated by the participation of more than two parents. Indeed, we still cannot be sure that certain of his hybrids did not in fact arise in such a way. Although arguments for multiple fertilisation as a normal event now have significance only for the history of biology, the case for the occurrence of successful multiple fertilisation as a rare accident remains equally unrefuted and unproven. The entry of more than one male nucleus into the egg cell has clearly been observed as a rare phenomenon in several different organisms. What is less certain is how often this act results in the development of a polyploid but otherwise normal embryo. (See: AUSTIN, 1965, pp. 109–117). If it were to prove demonstrable, it could only be done by genetic experimentation in a manner not perhaps in essence very different from Lowe's own experiments, but the marker characters used must be more different from one another than those used by Lowe, affecting distinct aspects of the plant, and the manner of their inheritance needs to be known. Perhaps the most satisfactory demonstration would be the production of an interspecific hybrid simultaneously involving three species, but the practical difficulty of mounting such an experiment on a scale sufficient to allow an appreciable chance of success (assuming that success is biologically possible), will dissuade all but the most extreme optimist from attempting it.

The criticisms in the above appreciation are not intended to carry any reflection on what was a remarkable achievement, or to detract from the credit due to an extraordinary pioneer. The sheer volume of experimental work on fern hybridisation carried out by Lowe is astonishing, and has never yet been exceeded by one person. Thus we read (p. 73), that in one period of five years, from 1887–1892, Lowe instigated nearly 500 separate hybridisation experiments. Although the labour involved in instigating a hybridisation attempt by mixed sowing of spores is much less than that concerned when using more direct modern methods, the task of cultivation and classification of the progeny is very much more difficult. Some of the progenies raised from these sowings were extremely large, amounting on one occasion (p. 100), to two thousand 'seedlings'. It would scarcely be possible for one man to give so many experiments, including some of a high degree of complexity, the attention and critical analysis they would properly require.

No mention has yet been made of the fact that Lowe's hybridisation experiments had a secondary purpose, which was the production of new and more magnificent varieties for horticultural purposes and for exhibition. It is very clear from the account given (see pp. 42–62) that in this field he was pre-eminently and inordinately successful.

Finally, perhaps the most curious feature of Lowe's work on fern hybridisation is that in spite of its great volume, no records or results of his work appear to have survived, apart from his publications. Does anyone know the whereabouts of Lowe's herbarium?

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REVIEW

AN ANNOTATED BIBLIOGRAPHY OF MEXICAN FERNS by George Neville Jones, pp. 286, University of Illinois Press, 1966: price $5.00. 15.5 × 23.5 cm

In this bibliography of Mexican Ferns which includes Psilotopsida, Lycopsida and Sphenopsida over 1200 references are cited in the Author Index (pp. 1–237). The remaining pages (238–286) consist of four major "Finding Indexes" which are classified as follows: I GENERAL 1 Bibliography; 2 Collections, Expeditions etc.; 3 Economic and Horticultural Botany; 4 Geographical distribution, Floristics; 5 Herbaria; 6 Annotated lists, Catalogues etc.; 7 Floras, Monographs, Keys; 8 Nomenclature, Gazetteer, Illustrations; 9 Vegetation, ecology; 10 Morphology. II GEOGRAPHICAL (29 division of Mexico). III BIOGRAPHICAL (collectors and works on Mexican ferns). IV SYSTEMATIC.

That the author is interested both in Mexico and in ferns is seen from the annotations and this book is the result of obvious research in this field. A considerable number of references to taxa first described from elsewhere are included if Mr Jones has evidence of them being found in Mexico subsequently. Where any new species is described details of type specimen and where it now resides is given in the annotations.

One cannot review a book like this. One can say however that it will be of immense value to pteridologists and to other botanists alike who have interests in Central America. There is a supplement with only 20 additional references and with the method of printing used (photographically reproduced tyepwritten MS) one would have expected and hoped for a shorter period between the finalising of the manuscript (1962) and date of publication, 12 September 1966.

A. C. JERMY

BOLIVIAN PTERIDOPHYTES COLLECTED BY WINIFRED BROOKE

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ABSTRACT

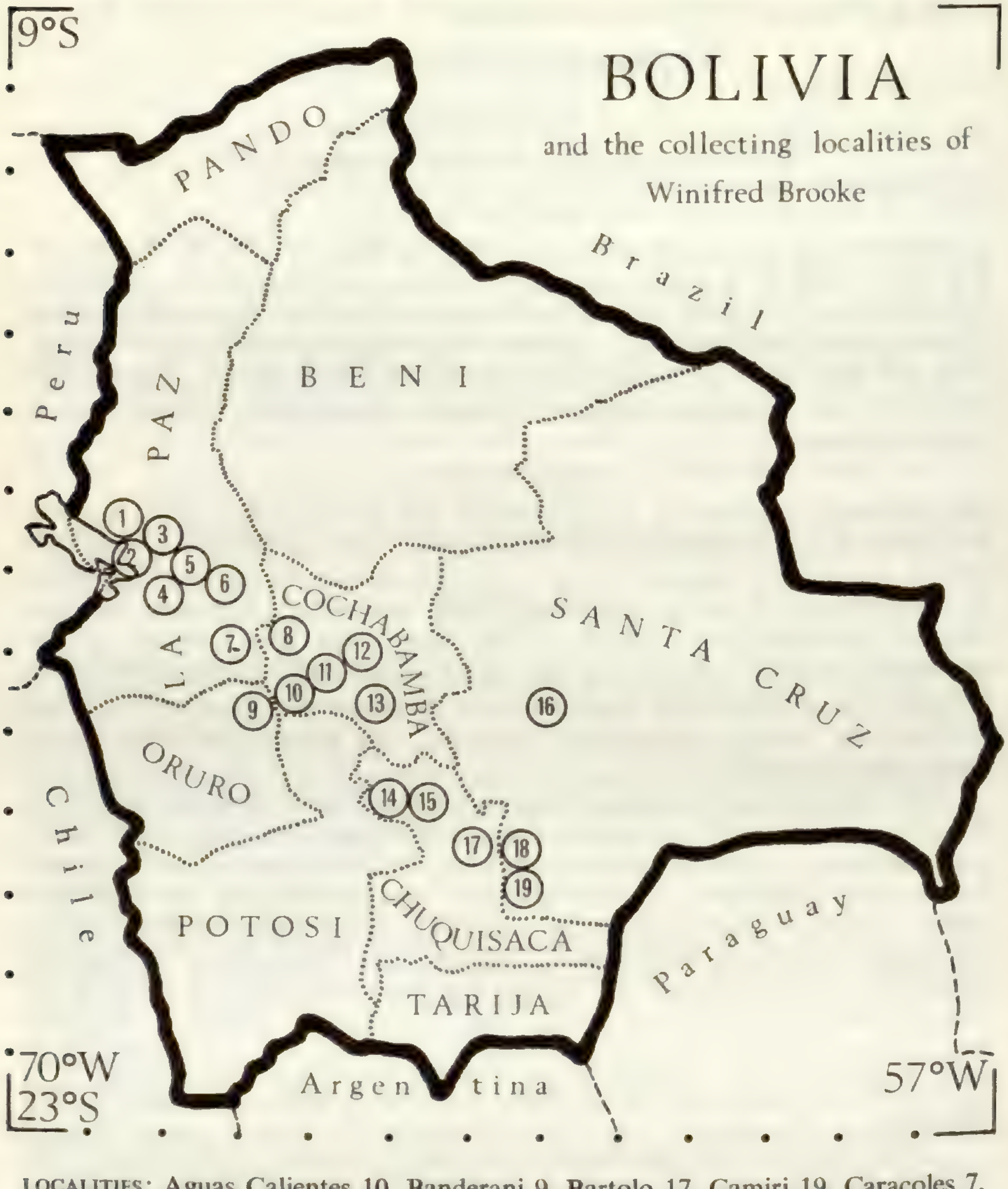
A collection of 194 pteridophytes made by Miss W. M. A. Brooke in Bolivia in 1948/50 is listed, together with an introduction to collectors in Bolivia and a bibliography which aims to cite all major works dealing with Bolivian pteridophytes. Twenty-one new nomenclatural combinations (in *Adiantum*, *Eriosorus*, *Microgramma*, *Thelypteris*, *Xiphopteris*) are made, and one *Selaginella* is in course of publication elsewhere as a new species.

INTRODUCTION

This account is based on a manuscript left by the late A. H. G. ALSTON in 1958. I have made several additions and corrections, but the botany is much as Alston left it. My sole motive in publishing under my name alone is to simplify the future citation of the new nomenclatural combinations. Most of the credit for the naming of the specimens and for recognizing the sparseness of literature on Bolivian pteridophytes should be accorded to Alston. In view of differing opinions on family and generic affinities, the genera and species are listed alphabetically.

Of previous collections of pteridophytes from Bolivia, those of Herzog and Stübel have been completely identified and published, complete but somewhat inaccurate lists of those made by Bang and Rusby have appeared, and those made by Buchtien are incompletely listed. The collections of Bridges, Cuming, Kelly and Pentland lacked localities. The fine collections of Mandon and D'Orbigny were never published as enumerations. Other collectors in Bolivia have been Pearce, Mexia, Fries, Fiebrig, Tate, Pflanz, Gunther, Williams, Weddell and Cárdenas. Specimens from some of the Bolivian collections have been quoted in the works of Fée, Hooker, Christ, Christensen and Maxon.

Miss Brooke was encouraged to make her trip by Dr John Ramsbottom, then Keeper of Botany at the British Museum (Natural History) and she was in Bolivia from December 1948 to November 1950. The places she visited are given on the map (page 310) drawn by Joyce Parker, and a descriptive account is in BROOKE (1952); field numbers 3002–6949 were collected in Bolivia, after which she went to Chile (numbers 6950–7086); field notes, determination lists and seed lists are at the British Museum (Natural History). In addition to collecting seeds for seed shareholders, Miss Brooke prepared herbarium specimens which are now deposited in the following institutions (in order of size of set): London (BM) [just over 2000 numbers], Chicago (F), New York (NY), Utrecht (U), Geneva (G), Stockholm (S), Washington (US). The specimens listed below are those in BM; attention should



BOLIVIA

and the collecting localities of Winifred Brooke

LOCALITIES: Aguas Calientes 10, Banderani 9, Bartolo 17, Camiri 19, Caracoles 7, Carmen 8, Caxata 7, Choreti 19, Choro 8, Chulumani 6, Cochabamba 11, Colomi 12, Colon 11, Cona Cona 10, Coroico 5, El Paradiso 6, Gran Poder 1, Heredia 17, Huanacota 7, Huatarata 2, Inchacaca 12, La Fabulosa 3, Lagunillas 18, La Paz 4, Locotal 12, Luruni 11, Mizque 13, Monteagudo 17, Oruro 9, Pampas Verdes 16, Parotani 11, Pongo 7, Quime 7, Rosal 17, Santa Cruz 16, Sivingani 13, Sorata 1, Sucre 14, Tacacoma 1, Tako Tako 13, Tanapaca 7, Taquina 11, Tres Cruces Pass 7, Tunari 8, Ulmapalca 3, Unduavi 5, Villa Eufronio Viscarra 13, Viloco 7, Zudanez 15.

be drawn to the occurrence of mixed gatherings.

ENUMERATION OF SPECIES

In order to reduce the printed matter, geographical details are listed here at the beginning; under the species, localities are listed in alphabetical order, together with information from Miss Brooke's plant labels.

LOCALITY (Department, *Province*) latitude; longitude

AGUAS CALIENTES (Cochabamba, *Arque*) 17.48S; 66.37W
AGUAS DE CASTILLAS (Oruro, *Cercado*), suburb of Oruro
CARACOLES (La Paz, *Inquisivi*) 16.59S; 67.24W
CARMEN (La Paz, *Nor Yungas*) 5–10 miles down the valley from Choro
CAXATA (La Paz, *Inquisivi*) 17.07S; 67.20W
CHALLANA (La Paz, *Larecaja*) 15.57S; 68.12W
CHORETI (Santa Cruz, *Cordillera*) 20.01S; 63.32W
CHORO (La Paz, *Nor Yungas*) 16.17S; 67.40W
CHULUMANI (La Paz, *Sud Yungas*) 16.24S; 67.31W
COLOMI (Cochabamba, *Chaparé*) 17.21S; 65.52W
CONA CONA (Cochabamba, *Arque*) 17.49S; 66.42W
COROICO (La Paz, *Nor Yungas*) 16.10S; 67.44W
EL PARADISO (La Paz, *Sud Yungas*), near Chulumani
GRAN PODER (La Paz, *Larecaja*), gold-mine between Sorata and Tacacoma
HEREDIA (Chuquisaca, *Azero*), 19.48S; 64.08W
HUATARATA (La Paz, *Omasuyos*) 16.10S; 68.44W
INCACHACA (Cochabamba, *Chaparé*) 17.14S; 65.49W
LA FABULOSA (La Paz, *Larecaja*), tin-mine at head of valley NE of Challana
LANGUNILLAS (Santa Cruz, *Cordillera*) 19.38S; 63.43W
LOCOTAL (Cochabamba, *Chaparé*) 17.11S; 65.48W
LURUNI (Cochabamba, *Ayopaya*), hot springs near Tunari
MIZQUE (Cochabamba, *Mizque*) 17.56S; 65.19W
ORURO (Oruro, *Cercado*) 17.59S; 67.09W
PAMPAS VERDES (Santa Cruz, *Cercado*), an estate about 12 miles from Santa Cruz
PONGO (La Paz, *Inquisivi*) 17.03S; 67.17W
QUIME (La Paz, *Inquisivi*) 17.02S; 67.15W
ROSAL (Chuquisaca, *Tomina*) 19.29S; 64.13W
SANTA CRUZ (Santa Cruz, *Cercado*) 17.48S; 63.10W
SORATA (La Paz, *Larecaja*) 15.47S; 68.40W
TACACOMA (La Paz, *Larecaja*) 15.35S; 68.43W
TRES CRUCES PASS (La Paz, *Inquisivi*) between Caxata and Quime
TUNARI (Cochabamba, *Ayopaya*) 16.59S; 66.40W
ULMAPALCA (La Paz, *Larecaja*), near La Fabulosa
UNDUAVI (La Paz, *Sud Yungas*) 16.19S; 67.54W
VILA VILA = Villa Eufronio Viscarra
VILLA EUFRONIO VISCARRA (Cochabamba, *Mizque*) 17.59S; 65.36W
VILOCO (La Paz, *Loayza*) 16.57S; 67.33W

Adiantum baenitzii Rosenst. CHORO, 2700m, on river bank, 23 Jan 50, **6058,** UNDUAVI, 1800m, on damp slope above road in valley below town, 15 Oct 50, **6882,**

A. digitatum C. Presl. CHORO, 2700m, on shady bank above river, Feb 50, **6928.** QUIME, 2490m, on wet bank under trees, 4 Apr 49, **5429** [with *5429A A. poiretii*]. SORATA, 2550m, in shady lane in damp thicket, 31 May 50, **6416.**

A. orbignyanum Mett. ex Kuhn. QUIME, 2400m, in sheltered gorge, 13 Apr 49, **5487**; 2550m, in rock in gorge, 13 May 49, **5490.** VILA VILA, 2100m, in crevices of rocks above river, 17 Dec 49, **5859.**

A. pilosum Fée. CHORO, 2850m, on steep grassy slope in valley, 21 Jan 50, **6025.** LURUNI, 2790m, in plantation, 10 Sep 50, **6791.** QUIME, 2400m, in wet plantation above river, 16 Mar 49, **5301.**

A. poiretii Wikstr. var. *poiretii.* QUIME, 2490m, on wet bank under trees, 4 Apr 49, **5429A** [with *5429 A. digitatum*].

A. poiretii var. **glaucescens** (Mett. ex Kuhn) Crabbe **comb. nov.** (*A. crenatum* Poir. var. *glaucescens* Mett. ex Kuhn in Abh. Naturf. Ges. Halle 11:29.1869). UNDUAVI, 1800m, on damp roadside bank in valley below town, **6883A** [with *6883 A. williamsii*].

A. tinctum T. Moore. ROSAL, 2010m, on rocks in glen, 30 Sep 49, **5725.**

A. williamsii T. Moore. CHORO, 2700m, under trees, 16 Mar 50, **6272.** UNDUAVI, 1800m, on damp roadside bank in valley below town, 15 Oct 50, **6883** [with *6883A A. poiretti* var. *glaucescens*].

Asplenium auritum Swartz. INCACHACA, 3000m, 22 Aug 50, **6784.**

A. bangii Hieron. ROSAL, 1950m, in damp shady glen, 3 Oct 49, **5740.**

A. castaneum Schlecht. & Cham. QUIME, 2850, beside path, 4 Apr 49, **5432A.** VILOCO, 4440m, in rock crevices on wet slope, 18 Mar 49, **5318.**

A. davallioides Hook. CARMEN, 2400m, on trunks of trees in warm forest, 11 Feb 50, **6129.**

A. foeniculaceum Kunth. CARMEN, 2400m, on trunk of tree in warm forest, 11 Feb 50, **6132A.** GRAN PODER, 3000m, in dense forest, Jun 50, **6295A**; 3000m, on shady bank, Jun 50, **6438.**

A. gilliesii Hook. AGUAS DE CASTILLAS, 3690m, in damp crevices of rock in dry district, 1 Mar 49, **5251.** LAGUNILLAS, 3000m, in wet forest, 7 Mar 50, **6276.**

A. harpeodes Kunze. GRAN PODER, 3000m, on shady bank, 3 Jun 50, **6437.** INCACHACA, 2400m, on tree in forest, 13 Aug. 50, **6681.**

A. lorentzii Hieron. SORATA, 2250m, on river bank, 1 Jun 50, **6415.** QUIME, 2700m, on shady bank, 4 Apr 49, **5430.**

A. monanthes L. SORATA, 2400m, on bank of stream, 30 May 50,

6407. QUIME, 2400m, on wet rocks in sheltered gorge, 13 Apr 49, **5488**; 2400m, between rocks by river in gorge, 13 Apr 49, **5491.**

A. praemorsum Swartz. COROICO, 1500m, 5 Jun 50, **6646.** QUIME, 3000m, 1 Apr 49, **5409**; 2400m, between boulders by river in sheltered gorge, 13 Apr 49, **5493.**

A. rhizophorum L. CHULUMANI, 2100m, in dense wet forest, 29 Jun 50, **6576.** INCACHACA, 2400m, in forest, 17 Aug 50, **6715.**

A. squamosum L. CARMEN, 2400m, in warm forest, 11 Feb 50, **6125.**

A. woodwardioideum Gardn. GRAN PODER, 3300m, 9 Jun 50, **6483.**

Azolla filiculoides Lam. CHORETI, 858m, on still water in backwater of river, 10 Sep 49, **5607.** HUATARATA, 3840m, on shallow water at edge of Lake Titicaca, 19 May 50, **6376.** MIZQUE, 1800m, on pool in river, 21 Dec 49, **5902.**

Blechnum andinum (Baker) C. Chr. INCACHACA, 3300m, on wet rock, 15 Aug 50, **6721.**

B. buchtienii Rosenst. GRAN PODER, 3000m, on wet grassy slope, 3 Jun 50, **6445.** LAGUNILLAS, 3000m, on top of cliff, 7 Mar 50, **6153.**

B. kunthianum C. Chr. INCACHACA, 3300m, on roadside bank, 15 Aug 50, **6729.**

B. occidentale L. SORATA, 2250m, on river bank, 1 Jun 50, **6412.**

Botrychium schaffneri Underw. CHORO, 3150m, on path through pasture, 19 Feb 50, **6135A.**

Campyloneurum aglaolepis (Alston) Sota. CHORO, 3090m, on shady bank, 18 Jan 50, **6005.** QUIME, 2400m, in crevices of rocks on far side of river, 5 Apr 49, **5441.**

C. lorentzii (Hieron.) Ching. ROSAL, 1950m, at edge of glen, 30 Sep 49, **5716.**

Cheilanthes marginata Kunth. QUIME, 2550m, common on shady wet rock wall, 31 Mar 49, **5402.**

C. myriophylla Desv. QUIME, 2550m, common on shady wet rock wall, 31 Mar 49, **5402A.**

C. pilosa Goldm. LA FABULOSA, 4500m, in rock crevices, 26 Apr 50, **6323.** Between PONGO and QUIME, 2490m, below rock beside road, 7 Apr 49, **5451.**

C. pruinata Kaulf. AGUAS DE CASTILLAS, 3900m, in rock crevices on dry sunny hilltop, 8 Mar 49, **5260.**

Cystopteris fragilis (L.) Bernh. CHORO, 2850m, on dripping rock by stream, 23 Jan 50, **6056.** QUIME, 2550m, on dripping rock in gorge, 13 Apr, **5489.**

Dennstaedtia glauca (Cav.) C. Chr. QUIME, 2400m, on wet ground beside river in a side valley, 5 Apr 49, **5426.**

Elaphoglossum aff. *accedens* (Mett.) Christ, probably undescribed.

CARMEN, 2400m, hanging from tree, 11 Feb 50, **6227.** Kew have a specimen from Colombia (*André 2362*) which is similar but has shorter scales on the under surface. The type-specimen of *Acrostichum accedens* Mett. *Mandon 8–bis*, (BD; photo BM) is from Bolivia.

E. angustissimum (Fée) C. Chr. INCACHACA, 2400m, on rock in open, 13 Aug 50, **6688.**

E. crassipes (Hieron.) Diels. QUIME, 2400m, among rocks in sheltered gorge, 9 Apr 49, **5463** [with *5463A E. leprosum*]; 3300m, on rock, 9 Apr 49, **5465.**

E. engelii (Karst.) Christ. GRAN PODER, 3000m, on steep grassy slope, 7 Jun 50, **6447.** UNDUAVI, 3120m, among shady rocks, 13 Oct 50, **6842A** [with *6842 E. lindenii*].

E. leprosum (Mett.) Christ. QUIME, 2400m, among rocks in sheltered gorge, 9 Apr 49, **5463A** [with *5463 E. crassipes*].

E. lindenii (Bory) T. Moore. INCACHACA, 2400m, on rock, 13 Aug 50, **6674.** UNDUAVI, 3150m, among rocks in cloud district, 3 Jul 50, **6621**; 3120m, among shady rocks, 13 Oct 50, **6842** [with *6842A E. engelii*].

E. mandonii (Mett.) Christ. LAGUNILLAS, 3000m, in wet forest, 7 Mar 50, **6207.**

E. mathewsii (Fée) T. Moore. CHORO, 3150m, on rocks near stream on open slope, 18 Jan 50, **5992A** [with *5992 E. unduavense*]. ULMAPALCA, 4050m, by river, 27 Apr 50, **6337.**

E. mettenii (Kuhn) Christ. UNDUAVI, 3150m, on rocks in cloud district, 3 July 50, **6620.** A specimen from Ecuador (*Jameson 315*) at Kew is rather larger and stouter with paler scales and frond a little more cuneate at base.

E. unduavense Rosenst. CHORO, 3150m, on rocks near stream on open slope, 18 Jan 50, **5992** [with *5992A E. mathewsii*].

Equisetum bogotense Kunth. QUIME, 2400m, on wet ground near river, 5 Apr 49, **5440.** SORATA, 2400m, on wet shady bank of stream, 30 May 50, **6402.**

Eriosorus elongatus (Hook. & Grev.) Copel. LAGUNILLAS, 2850m, on tree, 6 Mar 50, **6196A** [with *6196 Jamesonia scalaris* and *6196B J. peruviana*].*

E. mathewsii (Hook.) Crabbe **comb. nov.** (*Gymnogramma mathewsii* Hook., Sp. Fil. 5:128.1864) INCACHACA, 3300m, on wet bank of road, 15 Aug 50, **6725.**

E. orbignyanus (Mett.) A. F. Tryon. INCACHACA, 2400m, in damp tangles on slope in ravine, 19 Aug 50, **6768.**

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*6196 is a mixture at BM. Alston had split it into *6196 Jamesonia scalaris* and *6196A Eriosorus elongatus*. I have separated *6196B* as *Jamesonia peruviana*. A. F. Tryon (Contrib. Gray Herb. Harv. Univ. 191 : 168, 178. 1962) cites *6196* at U as *J. peruviana*, and at US under both *J. peruviana* and *J. scalaris*.

E. retrofractus (Kunze ex Mett.) Crabbe **comb. nov.** (*Gymnogramma retrofracta* Kunze ex Mett., Fil. Lechl. 1:10.1856). UNDUAVI, 3000m, on shady roadside bank, 1 Jul 50, **6598.**

E. rufescens (Fée) A. F. Tryon. LA FABULOSA, 4500m, hanging under damp shady rocks, 30 Apr 50, **6343.** This seems to be a well developed example of this species which was described from smaller plants from Peru: *Lechler 2255.*

Gleichenia bifida (Willd.) Spreng. CHULUMANI, 2100m, on banks above road at edge of forest, 18 Jun 50, **6508.** COROICO, 1440m, on open sunny slope, 5 Jul 50, **6632.**

Hymenophyllum abietinum Hook. & Grev. LAGUNILLAS, 3000m, on trees in forest, 7 Mar 50, **6165.** UNDUAVI, 3150m, on wet bank in deep shade in cloud district, 3 Jul 50, **6617.**

H. elegantulum Bosch. GRAN PODER, 2850m, on wet mossy bank, 6 Jun 50, **6459.** UNDUAVI, 3150m, on wet bank in deep shade, 3 Jul 50, **6618**; 3060m, on wet rock in cloud district, 15 Oct 50, **6894B** [with *6894 H. speciosum* and *6894A. H. myriocarpum*].

H. ferax Bosch. UNDUAVI, 3060m, under wet rock, 15 Oct 50, **6893** [with *6893A H. speciosum*].

H. fucoides Swartz. GRAN PODER, 3600m, by spring in grotto, 10 Jun 50, **6473.** INCACHACA, 3300m, on wet rock in glen, 15 Aug 50, **6727.**

H. myriocarpum Hook. CARMEN, 2400m, in moss on trunks of trees in warm forest, 11 Feb 50, **6130.** GRAN PODER, 3600m, on wet dark bank of stream, 10 Jun 50, **6471.** INCACHACA, 3300m, on wet rock in glen, 15 Aug 50, **6726.** LAGUNILLAS, 3000m, on trees in wet forest, 7 Mar 50, **6190B.** UNDUAVI, 3060m, on wet rock in cloud district, **6894A** [with *6894 H. speciosum* and *6824B H. elegantulum*].

H. pyramidatum Desv. INCACHACA, 2400m, on bank in dense forest, 14 Aug 50, **6689**; 2700m, on tree, 15 Aug 50, **6746.**

H. secundum Hook. & Grev. UNDUAVI, 3150m, on damp rocks in misty district, 3 Jul 50, **6619**; 3060m, on wet shady rocks, 13 Oct 50, **6831.**

H. speciosum Bosch. CARMEN, 1800m, hanging from branch of tree in warm forest, 11 Feb 50, **6131.** UNDUAVI, 3060m, under wet rock, 15 Oct 50, **6893A** [with *6893 H. ferax*]; 3060m, on wet rock in cloud district, 15 Oct 50, **6894** [with *6894A H. myriocarpum* and *6893B H. elegantulum*].

Jamesonia peruviana A. F. Tryon. LAGUNILLAS, 2850m, on trees, 6 Mar 50, **6196B** [with *6196 J. scalaris* and *6196A Eriosorus elongatus*].

J. scalaris Kunze. LAGUNILLAS, 2850m, on trees, 6 Mar 50, **6196** [with *6196A Eriosorus elongatus* and *6196B Jamesonia peruviana*].

Lycopodium cernuum L. EL PARADISO, 2100m, by path through

swamp in dense cloud forest, 29 Jun 50, **6569.** HEREDIA, 1200m, on rocks in gorge, 22 Sep 49, **5671.**

L. clavatum L. CHORO, 3300m, near stream in glen, 18 Jan 50, **6015.** GRAN PODER, 3000m, on wet shady bank, 4 May 50, **6424.** INCACHACA, 2700m, on bank by road in forest, 15 Aug 50, **6720.** UNDUAVI, 3000m, on damp slopes in partial shade in cloud district, 1 Jul 50, **6597A** [with *6597 L. jussiaei* and *6597B L. reflexum*].

L. complanatum L. CHULUMANI, 2100m, hanging down bank in wet forest, 18 Jun 50, **6511.** INCACHACA, 3000m, on damp bank in forest, 24 Aug 50, **6781.**

L. cruentum Spring. CHORO, 4050m, in marsh around a spring, 24 Feb 50, **6260.**

L. jussiaei Desv. CHULUMANI, 1950m, under bushes on slope, 25 Jun 50, **6562.** UNDUAVI, 3000m, on damp slopes in partial shade in cloud district, 1 Jul 50, **6597** [with *6597A L. clavatum* and *6597B L. reflexum*]; 2850m, on wet banks beside road, 3 Jul 50, **6611.**

L. lechleri Hieron. GRAN PODER, 3150m, on bushy slope beside river, 10 Jun 50, **6492**.

L. magellanicum Swartz. CHORO, 3750m, 6 Feb 50, **6118.**

L. mettenii Hieron. CARMEN, 2400m, hanging from tree in warm forest, 11 Feb 50, **6132.**

L. reflexum Lam. Between COROICO and UNDUAVI, 3150m, on open slope by road, 16 Oct 50, **6907.** UNDUAVI, 3000m, on damp slopes in partial shade in cloud district, 1 Jul 50, **6597B** [with *6597 L. jussiaei* and *6597A L. clavatum*].

L. saururus Lam. CHORO, 3900m, on wet open rocky slope, 3 Feb 50, *6095*. LA FABULOSA, 4650m, on open slope, 1 May 50, *6347*.

Microgramma chrysolepis (Hook.) Crabbe **comb. nov.** (*Polypodium chrysolepis* Hook., Ic.Pl.8:t.721.1844). CHORO, 3000m, on tree and rock, 27 Jan 50, **6081.**

M. cordata (Desv.) Crabbe **comb. nov.** (*Polypodium cordatum* Desv. in Mém. Soc. Linn. Paris 6:226.1827). INCACHACA, 2400m, climbing up bush at edge of forest, 12 Aug 50, **6661.** Between PONGO and QUIME, 3150m, encrusted on wet shady rock by road, 7 Apr 49, **5456.**

M. galatheae (C. Chr.) Crabbe **comb. nov.** (*Polypodium galatheae* C. Chr. in Bot. Tidsskr. 25:79.1902). PAMPAS VERDES, 4500m, on tree, 11 Nov 49, **5786.**

M. piloselloides (L.) Copel. UNDUAVI, 3150m, on wet shady bank, 3 Jul 50, **6636.**

M. squamulosa (Kaulf.) Sota. QUIME, 1500m, hanging down over rocks in subtropical gorge across bridge far below town, 21 Apr 49, **5503.** ROSAL, 2010m, among roots of tree in shade, 28 Sep 49, **5691.**

Nephrolepis pendula (Raddi) J. Sm. CHULUMANI, 2100m, in dense wood, 18 Jun 50, **6597**; 1800m, on damp shady bank, 24 Jun 50, **6535.**

Notholaena aurea (Poir.) Desv. QUIME, 2850m, beside path, 4 Apr 49, **5432.** ROSAL, 2010m, on shady bank by road, 30 Sep 49, **5727.**

N. buchtienii Rosenst. QUIME, 2400m, on bank near river, 5 Apr 49, **5443.**

N. nivea (Poir.) Desv. AGUAS DE CASTILLAS, 3600m, in rock crevice, 1 Mar 49, **5253.**

Ophioglossum crotalophoroides Walt. CONA CONA, 4200m, in short grass in marsh, 8 Feb 49, **5219.** TRES CRUCES, 4800m, in short wet grass, 11 Apr 49, **5272.**

Pellaea ovata (Desv.) Weatherby. QUIME, 1800m, on rocks and banks in hot wet gorge across bridge far below town, 21 Apr 49, **5509.**

P. tenera (Gill.) Prantl. AGUAS CALIENTES, 3420m, in wet rock crevices, 30 Jan 49, **5183.**

P. ternifolia (Cav.) Link. AGUAS DE CASTILLAS, in rock crevices at top of hill, 27 Feb 49, **5229.**

Pessopteris crassifolia (L.) Underw. & Maxon. QUIME, 2400m, under boulders near river, 5 Apr 49, **5436**; 2400m, between rocks in sheltered gorge, 5 Apr 49, **5500.** ROSAL, 1890m, on rock by stream in dark glen, 3 Oct 49, **5736.**

Pityrogramma austro-americana Domin. CHULUMANI, 1800m, on shady roadside bank, 23 Jun 50, **6545** [with *6545A P.calomelanos*].

P. calomelanos (L.) Link. CHULUMANI, 1800m, on shady roadside bank, 23 Jun 50, **6545A** [with *6545 P. austro-americana*].

Polypodium bryopodum Maxon. QUIME, 2400m, on rock near river, 5 Apr 49, **5442.**

P. crystalloneuron Rosenst. CARMEN, 2400m, on trees in forest, 11 Feb 50, **6275.**

P. filicula Kaulf. ROSAL, 1890m, on damp rocks in shady glen, 3 Oct 49, **5739.**

P. lomariiforme Kunze. On short cut to PONGO from QUIME, 2850m, between rocks, 7 Apr 49, **5447.**

P. loriceum L. CHULUMANI, 2100m, in dense damp forest, 29 Jun 50, **6568.**

P. semipinnatifidum (Fée) Mett. INCACHACA, 2400m, in partial shade at edge of forest above river, 13 Aug 50, **6687.**

P. sessilifolium Desv. CHORO, *c.*3300m, on trees, 21 Jan 50, **6032.**

Polystichum polyphyllum Presl. CARACOLES, 3900m, among boulders by river, 23 Apr 49, **5517.** LA FABULOSA, 4500m, in rock crevice, 26 Apr 50, **6306, 6307**; 4500m, in damp rock cave, 30 Apr 50, **6342.**

P. yungense Rosenst. COLOMI, 3600m, on marshy grass slopes, 7 Jan 49, **5095** [with *5905A Thelypteris pavoniana*].

Selaginella cruegeri Jenman. LAGUNILLAS, 3000m, in wet wood, 7 Mar 50, **6256.**

S. macrophylla A. Braun. About 5 miles along road from INCACHACA to LOCOTAL, 1800m, beside forest road, 20 Aug 50, **6765.**

S. marginata (Humb. & Bonpl.) Spring. SANTA CRUZ, 4500m, covering ground near river in forest, 25 Nov 49, **5844.**

S. microphylla (Kunth) Spring. SORATA, 2400m, Jun 50, **6649.**

S. novae-hollandiae (Swartz) Spring. INCACHACA, 2400m, under rock in ravine, 13 Aug 50, **6673.**

S. trisulcata Asplund. CHULUMANI, 2100m, in wet glen in cloud district, 22 Jun 50, **6531.** INCACHACA, 2400m, beside path in wet gorge, 12 Aug 50, **6659.**

S. sp.nov.aff. *S. popayanensis* Hieron. INCACHACA, 3000m, 22 Aug 50, **6783.**

Thelypteris pavoniana (Klotzsch) Crabbe **comb. nov.** (*Polypodium pavonianum* Klotzsch in Linnaea 20:386.1847). COLOMI, 3600m, on marshy grass slopes, 7 Jan 49, **5095A** [with *5095 Polystichum yungense*].

Trichomanes tenerum Spreng. ROSAL, 1920m, close to stream in glen, 30 Sep 49, **5729.**

Trismeria trifoliata (L.) Diels var. *aurea* Fée. Twelve miles below VILA VILA, 2040m, in wet sunny ground, 25 Mar 50, **6223.**

Woodsia crenata (Kunze) Hieron. CHORO, 3300m, hanging down wet rock in shady glen, 30 Jan 50, **6091.** LA FABULOSA, 4500m, in shady rock crevices, 28 Apr 50, **6326.** QUIME, 3000m, on rocks on mountain slope, 1 Apr 49, **5409A.** VILOCO, 4500m, in rock crevices, 20 Mar 49, **5344**; 4350m, in rock crevices, 27 Mar 49, **5380.**

Xiphopteris allosuroides (Rosenst.) Crabbe **comb. nov.** (*Polypodium allosuroides* Rosenst. in Meded. Rijks-Herb. 19:16.1913). LA FABULOSA, 4500m, under rocks in shade, 2 May 50, **6371.**

X. aromatica (Maxon) Crabbe **comb. nov.** (*Polypodium aromaticum* Maxon in Proc. U.S. Nat. Mus. 27:743.1904). CHORO, 3000m, on tree, 30 Jan 50, **6088**; **6089A** [with *6089 X. subscabra*].

X. capillaris (Desv.) Crabbe **comb. nov.** (*Polypodium capillare* Desv. in Berl. Mag. 5:316.1811). INCACHACA, 3300m, on damp roadside bank, 15 Aug 50, **6731.**

X. choquetangensis (Rosenst.) Crabbe **comb. nov.** (*Polypodium choquetangense* Rosenst. in Meded. Rijks-Herb. 19:18.1913). CHORO, 3300m, hanging down wet rock in wooded glen, 2 Feb 50, **6090.**

X. heteromorpha* var. **dependens** (Baker) Crabbe **comb. nov.** (*Poly-*

*__Xiphopteris heteromorpha__ (Hook. & Grev.) Crabbe **comb. nov.** (*Polypodium heteromorphum* Hook. & Grev., Ic. Fil. 1: t. 108. 1829).

podium dependens Baker in Hook. & Baker, Syn. Fil.: 335.1867). GRAN PODER, 3600m, in wet dark grotto, 10 Jun 50, **6472.** UNDUAVI, 3150m, in deep shade on wet bank, 3 Jul 50, **6615.**

X. lanigera (Desv.) Crabbe **comb. nov.** (*Polypodium lanigerum* Desv. in Berl. Mag. 5:316.1811). About 5 miles along road from INCACHACA to LOCOTAL, 1800m, on tree in forest, 20 Aug 50, **6762.**

X. moniliformis (Lag. ex Swartz) Crabbe **comb. nov.** (*Polypodium moniliforme* Lag. ex Swartz, Syn. Fil.: 33.1806). CHORO, 3000m, in forest, 2 Feb 50, **6278.** GRAN PODER, 3000m, on wet bank, 10 Jun 50, **6289.**

X. myriophylla (Mett.) Crabbe **comb. nov.** (*Polypodium myriophyllum* Mett., Fil. Lechl. 1:6.1856). INCACHACA, 3600m, in sphagnum on wet rock on damp roadside bank in forest, 15 Aug 50, **6730.**

X. peruviana (Desv.) Crabbe **comb. nov.** (*Polypodium peruvianum* Desv. in Mém. Soc. Linn. Paris 6:231.1827). QUIME, 2700m, on wet bank 5 Apr 49, **5428.** VILOCO, 4440m, in rock crevices on wet slope, 18 Mar 49, **5316.**

X. pilosissima (Martens & Gal.) Crabbe **comb. nov.** (*Polypodium pilosissimum* Martens & Galeotti in Mém. Acad. Brux. 15:39.t.9. f.2. 1842). About 5 miles along road from INCACHACA to LOCOTAL, 1800m, on tree in forest, 20 Aug 50, **6761.**

X. pozuzoensis (Baker) Crabbe **comb. nov.** (*Polypodium pozuzoense* Baker in Hook., Ic. Pl. 17:t.1672.1886). CARMEN, 2400m, hanging from tree in warm forest, 11 Feb 50, **6134.**

X. sodiroi (Christ & Rosenst.) Crabbe **comb. nov.** (*Polypodium sodiroi* Christ & Rosenst. in Repert. Nov. Spec. Regni Veg. 5:14.1908). LA FABULOSA, 4500m, in shady rock crevices, 28 Apr 50, **6325.**

X. subscabra (Klotzsch) Crabbe **comb. nov.** (*Polypodium subscabrum* Klotzsch in Linnaea 20:377.1847). CHORO, 3000m, on tree, 30 Jan 50, **6089** [with *6089A X. aromatica*].

X. yungensis (Rosenst.) Crabbe **comb. nov.** (*Polypodium yungense* Rosenst. in Repert. Nov. Spec. Regni Veg. 5:236.1908). LAGUNILLAS, 3000m, on trees in wet forest, 7 Mar 50, **6166.**

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BOOK NOTE

THE PICTORIAL ENCYCLOPEDIA OF PLANTS AND FLOWERS, London: Paul Hamlyn, New York: Crown Publishers, 1966. This book is deployed around F. A. Novak's marvellous collection of 1120 photographs. Arranged in a botanical order and connected by an authoritative verbal story they form a treasure trove for reference and browsing. As one journeys through the plant kindom, from bacteria to grasses, each group is a small world of its own. The ferns and fern-allies are illustrated by 27 species, 11 of which are well-known foreigners, the remaining 16 occurring wild in the British Isles. At 25 shillings this is wonderful value, as also is the companion volume on the animal kingdom.

J. A. CRABBE

A CONTRIBUTION TO THE CYTOTAXONOMY OF *ASPLENIUM MAJORICUM*

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Asplenium majoricum Litard. is a rare plant, probably endemic to the island of Mallorca*, where it occurs only in a few localities in the mountains bordering the north-west coast. It is a small fern of rock crevices, and was first described by LITARDIERE (1911) from walls near the town of Sóller. It is still found in this neighbourhood, at altitudes from 100–350 m, although elsewhere it is known to occur up to 700 m.

As the ecology of *A. majoricum* has recently been made the subject of a special study by ORELL & JACQUOTET (ined.) it is sufficient to say here that the plant characteristically occurs in pockets of heavy, red, base-rich clay in dry limestone walls bounding the terraces of olive groves; it prefers light shade and northern exposure. It is usually accompanied by much *A. trichomanes* L. subsp. *quadrivalens* D. E. Meyer, and by *Ceterach officinarum* DC., *Selaginella denticulata* (L.) Link, *Sedum dasyphyllum* L. and a small *Polypodium*, probably a dwarf form of *P. australe* Fée. It is sometimes associated with *A. petrarchae* (Guérin) DC. In common with many other Mediterranean ferns *A. majoricum* has its main growing season from October until March. During the dry summer months the fronds roll up as in *Ceterach* and *Asplenium petrarchae*, but if drought does not last too long these fronds will be revived by the first heavy rain. New growth starts towards the end of September, and continues actively during the winter and early spring.

A general similarity in appearance between *A. majoricum* and some forms of *A. fontanum* (L.) Bernh. has been pointed out by several authors, including LITARDIERE (1911), while others have stressed a resemblance to *A. petrarchae*. These three taxa are all included in *Flora Europaea* (CRABBE, *et al.*, 1964), but *A. majoricum*, at that time considered a taxon of doubtful status, was described only briefly and

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*Regarding the possible occurrence of *A. majoricum* outside Mallorca, two possibly relevant reports from the mainland of Spain are given by Knoche & Martinez (in MARTINEZ, M. 1934. *Mem. Soc. Esp. Hist. Nat.* 14: 421 and 425–6) from the province of Valencia (Sierra de Ondara and the Sierra de Bernia, near Alicante). One of these records refers to *A. valentinum*, a taxon described by PAU in 1895 (*Act. Soc. Esp. Hist. Nat.* 23: 174) as a putative hybrid between *A. fontanum* and *A. petrarcahe*. This plant is described as " glandular hairy " and without studying the type material it must be assumed from the description that *A. valentinum* has closer affinities with *A. petrarchae* and is therefore not identical with *A. majoricum*. In spite of this, KNOCHE in 1921 (*Flora Balearica* 1: 295) made the combination *A. lanceolatum* Huds. var. *valentinum* (Pau) Knoche when describing the plant from the environs of Sòller. This author does however state that the Mallorcan plant is not hairy and from his description he is undoubtedly referring to the plant described by de Litardière as *A. majoricum*. As two different plants are apparently involved, the existence of true *A. majoricum* on the Iberian peninsula is doubtful, and until further evidence is available it is perhaps best to regard *A. majoricum* as probably endemic to the island of Mallorca.

FIGURE 1 Silhouettes (natural size) of fertile fronds from plants in cultivation at Leeds: A) *Asplenium majoricum* (4*x*) from Sóller, Mallorca. B) Synthesized triploid hybrid *A. fontanum*♂ × *A. majoricum*♀ in its second year of growth. C) *A. fontanum* (2*x*) from Isère, France.

was in consequence omitted from the key. A more detailed description was subsequently published by JERMY & LOVIS (1964), together with an amended key for distinguishing this species from other European members of the genus. These authors also described and illustrated the cytology of *A. majoricum* and showed it to be a tetraploid with n = 72. Discussion of its possible origin was however withheld pending the outcome of an experimental investigation. It can now be shown, on the evidence presented below, that *A. majoricum* is yet another allotetraploid *Asplenium*, and that *A. fontanum* is one of the

two ancestral types.

THE EXPERIMENTAL INVESTIGATION

The observations recorded here were obtained during the course of an extensive study of synthesized *Asplenium* hybrids (SLEEP, 1966) only a few of which are relevant to the problem of *A. majoricum*. Five interspecific hybrids combining *A. majoricum* with other diploid or tetraploid species have however given significant information and the numerical details of inseminations versus hybrids raised are given in TABLE I. A single strain of *A. majoricum* from Sóller, Mallorca, was used throughout, although sometimes as male and sometimes as female. For the other species there was usually a choice of strains, and wherever possible hybridization attempts were made with material from different localities. No significant differences in compatibility could however be detected as a result of this procedure and therefore only the collective figures for any one type of hybrid are included in the table. Further information concerning the sources of material successfully incorporated into hybrids is given as an appendix (p. 329). It is noteworthy that very large numbers of prothalli must in most cases be inseminated in order to obtain even a modest yield of hybrids.

Illustrations of the morphology of the various plants involved in this investigation will be found in FIGS 1–3. *A. majoricum* (4*x*) and *A. fontanum* (2*x*) are shown in FIG. 1 A & C, and other species successfully crossed with *A. majoricum* in FIG. 2. The corresponding hybrids are illustrated in FIG. 1 B and FIG. 3.

TABLE I

Numerical details of successful hybridisations involving *A. majoricum* (4*x*) with the species listed.*

		prothalli	sporophytes	selfs	died	hybrids	Percentage success
TRIPLOID HYBRIDS							
1. *A. fontanum* (2*x*)	♂	109	29	10	12	**7**	6.42%
2. *A. onopteris* (2*x*)	♀	26	9	7	0	**2**	2.86%
	♂	44	4	4	0	**0**	
3. *A. viride* (2*x*)	♀	265	9	5	3	**1**	0.38%
TETRAPLOID HYBRIDS							
4. *A. macedonicum* (4*x*)	♂	123	16	7	0	**9**	7.32%
5. *A. forisiense* (4*x*)	♂	9	2	0	0	**2**	22.2%

*Attempts have been made, with varying degrees of persistence, to synthesize hybrids between *A. majoricum* and certain other species of *Asplenium*, namely *A. obovatum* (2*x*), *A. trichomanes* subsp. *trichomanes* (2*x*), *A. jahandiezii* (2*x*) and *A. petrarchae* (4*x*) but without success. In the case of *A. obovatum* over 400 prothalli were inseminated.

The chromosome pairing encountered at meiosis in the hybrids listed in TABLE 1 is summarised in TABLE 2. In all cases a minimum of 6 cells was analysed and where alternative specimens were available more than one hybrid plant was investigated.

Examples are illustrated in PLATE I and in FIGS 4 and 5.

TABLE II

Chromosome pairing in hybrids involving *A. majoricum* (4*x*) with the species listed.

(*Note*—In *Asplenium* the monoploid chromosome number is 36)

	No. plants analysed	Chromosome pairing	
		Bivalents	Univalents
TRIPLOID HYBRIDS			
1. *A. fontanum* (2*x*)	4	36	36
2. *A. onopteris* (2*x*)	2	0	108
3. *A. viride* (2*x*)	1	0	108
TETRAPLOID HYBRIDS			
4. *A. macedonicum* (4*x*)	5	*c.* 36	*c.* 72
5. *A. forisiense* (4*x*)	1	*c.* 36	*c.* 72

INTERPRETATION

The most important feature recorded in TABLE 2 is the presence of two different patterns of chromosome pairing among the triploid hybrids. Had item 1 (*A. majoricum* × *A. fontanum*) stood alone there would have been two possible interpretations, namely (*a*) that the pairs represent *A. fontanum* chromosomes which have found partners among half the nuclear complement of *A. majoricum*, or (*b*) that the pairs are autosyndetic, i.e. that they involve only *A. majoricum* chromosomes. On the first interpretation *A. majoricum* would be an allopolyploid, with *A. fontanum* representing one ancestral type. The second interpretation, on the other hand, would indicate an essentially autopolyploid origin for the tetraploid species.

The evidence provided by hybrids 2 and 3 in TABLE 2 eliminates the second alternative. Autosyndetic pairing is not displayed when *A. majoricum* is crossed with genuinely unrelated species since in two cases we find 108 univalents.* These facts thus strongly favour the view that *A. majoricum* is an allopolyploid and that *A. fontanum* or a form with similar chromosomes is one of its parents.

The nature of the second parent is less easily determined, although certain species can definitely be excluded. Thus *A. onopteris* L. and *A. viride* Huds. can both be ruled out by the failure of chromosome pairing displayed by hybrids 2 and 3 discussed above. *A. obovatum* Viv. can almost certainly be excluded by the evidence from the tetraploid hybrids (items 4 and 5 in TABLE 2), although the reasoning here is indirect. There is strong reason to believe (SLEEP 1966) that both

*Identical results have been obtained from both these hybrids under varying weather conditions and at different times of year.

A. macedonicum Kümm. (4*x*) and *A. forisiense* Le Grand (4*x*) contain genomes corresponding to the same two diploid species, namely *A. fontanum* and *A. obovatum*, and if this interpretation is correct the 36 bivalents observed in hybrids 4 and 5 would in each case represent *A. fontanum* chromosomes, those of *A. obovatum* being without partners.

Some additional evidence similarly excluding *A. trichomanes* L. subsp. *trichomanes* can be quoted from a hybrid recently synthesised by LOVIS (1966). This is a tetraploid cross between *A. majoricum* and *A. adulterinum* Milde (4*x*). It shows complete failure of pairing, forming 144 univalents at meiosis. This fact still further confirms the allopolyploid nature of *A. majoricum*, but since the genomic composition of *A. adulterinum* is known it provides further negative evidence regarding the second parent of *A. majoricum*. *A. adulterinum* is also allopolyploid with *A. viride* and *A. trichomanes* subsp. *trichomanes* as the two parental types (LOVIS, 1955, 1966). The new hybrid thus excludes *A. trichomanes* subsp. *trichomanes* as well as confirming the lack of affinity with *A. viride* which is already known.

At an earlier stage in the enquiry attempts at hybridizing *A. majoricum* directly with *A. trichomanes* subsp. *trichomanes* (2*x*) had been made without success. This new indirect evidence is therefore important, more especially in view of the black petiole in *A. majoricum* and the fact that CHRISTENSEN (1913) interpreted hybrids described in the literature as *A. trichomanes* × *A. fontanum* as equivalent to *A. majoricum*. Morphology alone is thus an insufficient guide to affinity in this case.

There is thus at present no evidence regarding the nature of the second species involved with *A. fontanum* in the parentage of *A. majoricum* beyond the exclusion of *A. viride*, *A. onopteris*, *A. obovatum* and *A. trichomanes*. However, Professor T. Reichstein (personal communication) has suggested that a diploid form of *A. petrarchae* might be the missing second parent. Specimens of *A. petrarchae* from localities near Sóller have been examined by Dr Lovis (personal communication) and myself and shown to be tetraploid. A diploid nevertheless exists, recently described by MEYER (1964) under the name of *A. glandulosum* subsp. *bivalens* D. E. Meyer (*A. glandulosum* Lois. is a synonym for *A. petrarchae* (Guérin) DC.). The affinities of this new form are therefore clearly pertinent to this problem and are currently under investigation by other workers in Leeds.

ACKNOWLEDGEMENTS

Thanks are due to Dr J. D. Lovis for supplying the material of *A. majoricum* used in this investigation and for helpful discussion, to the gardening and technical staff of Leeds University Botany Department for their constant attention in the cultivation and care of the plants and for assistance with the photography, and to the staff at the British Museum (Natural History) for their advice. I also wish to thank Professor T. Reichstein who supplied much of the experimental material. A special debt of gratitude is owed to Sr J. Orell and his

wife, both for their hospitality and for showing me *Asplenium majoricum* in its native habitat. Lastly, I wish to express my thanks and appreciation to Professor I. Manton for her advice and encouragement, and for her help in preparing the manuscript for publication.

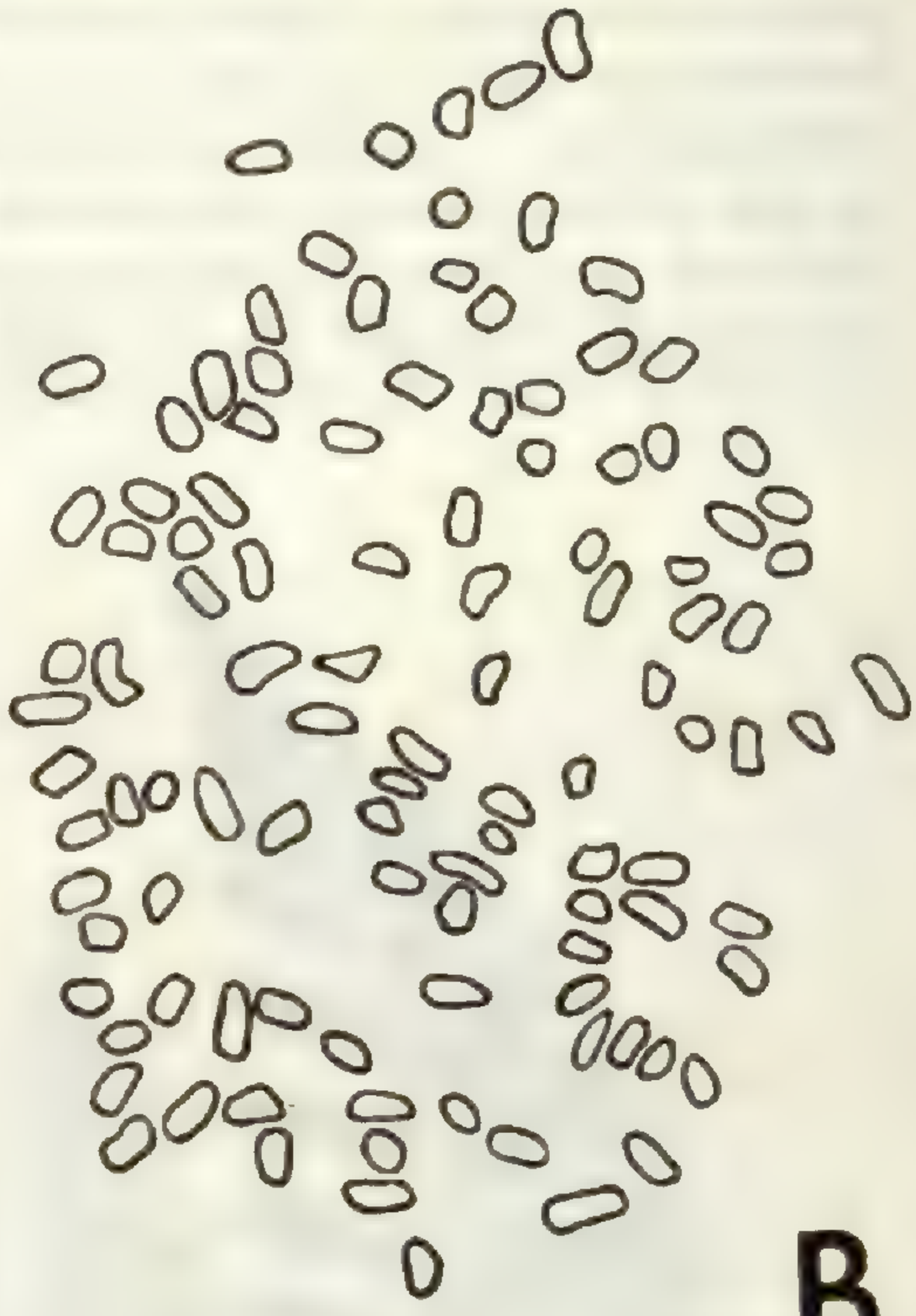
SUMMARY

Five types of interspecific hybrids involving the tetraploid *A. majoricum*

FIGURE 2 Silhouettes (natural size) of fertile fronds of other species of *Asplenium* incorporated into hybrids with *A. majoricum*. All from plants in cultivation at Leeds. A) *A. onopteris* (2*x*) from Aritzo, Sardinia. B) *A. viride* (2*x*) from Hutton Roof, Westmorland. C) *A. macedonicum* (4*x*) from Prilep, Macedonia.

Litard. with other diploid and tetraploid European species have been synthesized and their chromosome pairing analysed. The evidence indicates that *A. majoricum* is an allotetraploid species with *A. fontanum* as one of its parents. The other parent is still unknown although *A. viride*, *A. onopteris*, *A. obovatum* and *A. trichomanes* subsp. *trichomanes* (2*x*) can be excluded on positive evidence.

FIGURE 3 Silhouettes (natural size) of fertile fronds from synthesized hybrids involving *A. majoricum*. All from two year old plants in cultivation at Leeds: A) *A. majoricum*♂ × *onopteris*♀, triploid hybrid, TABLE 1 No. 2; B) *A. majoricum*♂ × *viride*♀, triploid hybrid, TABLE 1 No. 3; C) *A. macedonicum*♂ × *majoricum*♀, tetraploid hybrid, TABLE 1 No. 4.



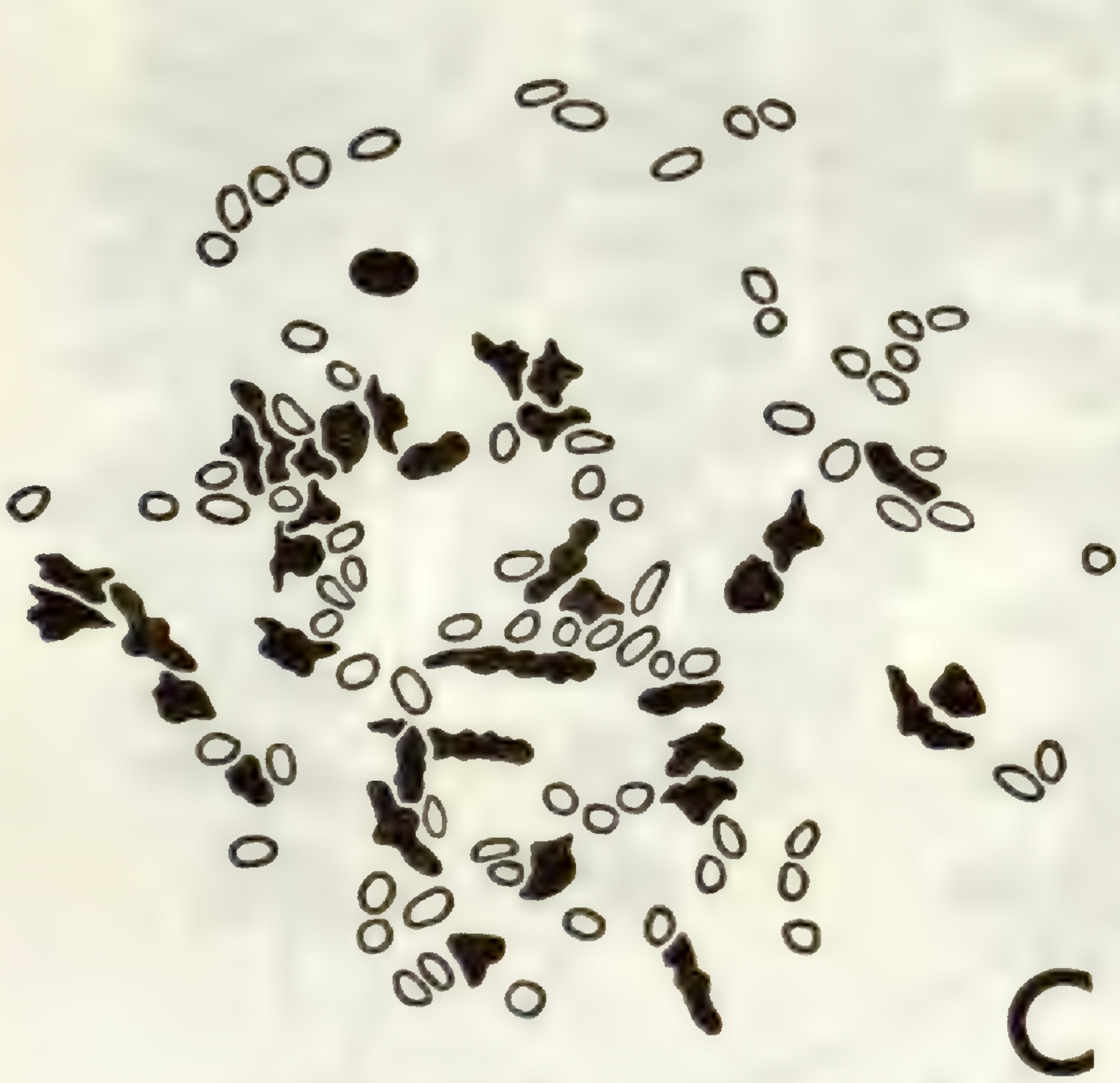


FIGURE 4 Chromosome pairing in synthesized hybrids; bivalents shown in black, univalents in outline. Magnification × 1500. A) Triploid hybrid *A. fontanum*♂ × *A. majoricum*♀. Explanatory diagram to PLATE 1A, showing 36 bivalents and 36 univalents. B) Diagram of meiosis in the triploid hybrid *A. majoricum*♂ × *A. onopteris*♀ (cytology not otherwise illustrated) showing 108 univalent chromosomes. C) Tetraploid hybrid *A. macedonicum*♂ × *A. majoricum*♀. Explanatory diagram to PLATE ID showing 35 vivalents and 74 univalents.

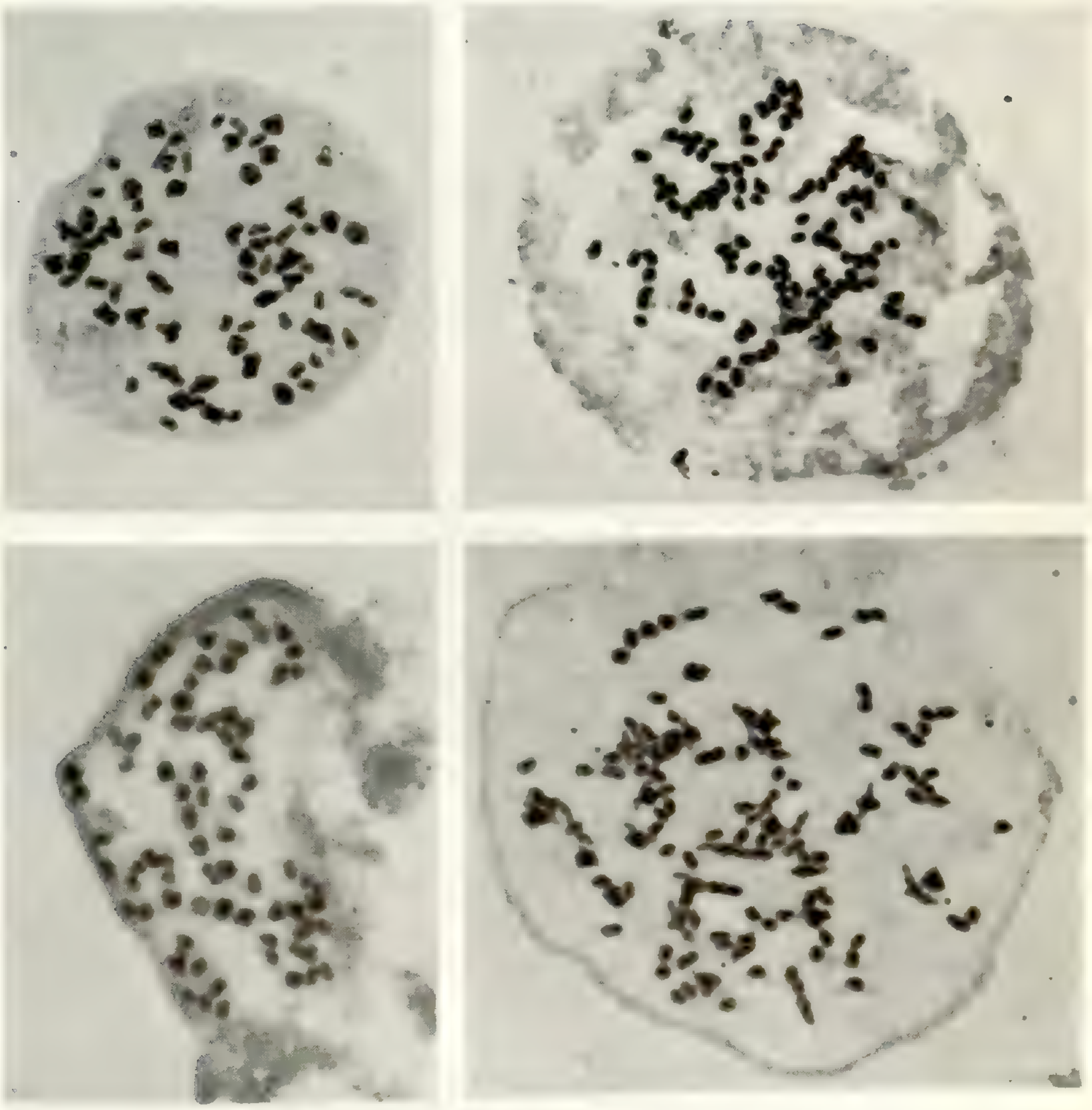


PLATE I

Photographs from permanent aceto-carmine squash preparations of spore mother cells in meiosis, all reproduced at a magnification of × 1000.

A) Synthesized triploid hybrid between *A. majoricum* from Sóller and *A. fontanum* from France, showing 36 pairs and 36 univalents. For explanatory diagram see FIG. 4A.

B) Synthesized triploid hybrid between *A. viride* from Westmorland and *A. majoricum*, showing 108 univalent chromosomes.

C) Meiosis in *Asplenium macedonicum* from Prilep, Macedonia. n = 72.

D) Synthesized tetraploid hybrid between *A. majoricum from* Sóller and *A. macedonicum* from Prilep, showing approximately n paired and 2n unpaired chromosomes. For explanatory diagram see FIG. 5.

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APPENDIX

Details of the sources of material successfully incorporated into hybrids

Species	Locality of origin	Source of spores	Collector
A. majoricum	C'as Patro Lau, Barranc, Sóller, Mallorca	Stock plants at Leeds	J. Orell
A. fontanum	Roche, Vaud, Switzerland	Stock plants at Leeds AS/24, AS/25	A. Sleep
A. fontanum	Villard de Lans, Isère, France	Stock plant at Leeds. Spores from Herb. Mus. Brit.	A. H. G. Alston
A. onopteris	Aritzo, Sardinia, Italy	Plant cultivated in Basel. TR 114	T. Reichstein
A. viride	Hutton Roof, Westmorland, Great Britain	Wild collection	A. Sleep
A. macedonicum	Markovgrad, N. of Prilep, Macedonia, S. Jugoslavia	Stock plants at Leeds. Alston 17776	A. H. G. Alston
A. forisiense	Brissago, Ticino, Switzerland	Plant cultivated in Basel. TR 34	T. Reichstein

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BOOK NOTE

An INDEX TO EUROPEAN TAXONOMIC LITERATURE FOR 1965, compiled by R. K. Brummitt, has been published by the International Bureau for Plant Taxonomy and Nomenclature (*106 Lange Nieuwstraat, Utrecht. 25/-*). Amongst some 2250 references to vascular plant taxonomy, 90 are given for Pteridophyta, and some further 190 to general and regional floristic work.

A. C. JERMY

JOHN SMITH OF KEW

R. E. HOLTTUM

Royal Botanic Gardens, Kew, Surrey

John Smith was one of the great pteridologists of the 19th century, and he was the only one of them who based his ideas mainly on observation of living plants. It was his misfortune that W. J. Hooker, under whom he served at Kew, did not take kindly to Smith's new ideas. He had also many other misfortunes. Today he is little known except to those who are concerned with the taxonomy and nomenclature of ferns, and his work for Kew has been too little recognized. This situation has been recently brought to the attention of the Kew community by an article by R. G. C. Desmond in the *Kew Guild Journal* of 1965 (pp. 576–587) entitled "John Smith, Kew's first Curator". The biographical data which follow are summarized from Mr Desmond; the main object of the present article is to call attention to John Smith's work on ferns.

He was born at Aberdour in Fifeshire on 5 October 1798, son of a gardener. After serving an apprenticeship he obtained a post at the Edinburgh Botanic Garden in 1818, and there took the opportunity to study botany. He came to London in 1820 and worked at the Royal forcing garden at Kensington. He was appointed to the Kew staff in 1822. In 1823 he became foreman of the hot-houses and propagating department, and was responsible for receiving new importations of plants from various places in the tropics. It was then that his interest in ferns began, but it was not his only interest. After the death of Sir Joseph Banks in 1820 Kew began a decline which led to the appointment of a Royal Commission in 1838 to consider the future of the Garden, and ultimately to a new lease of life for Kew as a national botanical institution from 1841 with Sir William Hooker as Director. During this difficult period John Smith was largely responsible for the maintenance of the whole collection of plants, and he evidently had a very wide knowledge of them. The Commission commended him, and he was appointed Curator, under the new regime, from 1841, a post he retained until in 1864 he was obliged to retire owing to failure of his sight. In 1880 he published *Records of the Royal Botanic Gardens, Kew*, in which he gave lists of species of plants with which he was concerned during his whole period of service, with many historical notes of varied kinds. He relates, for example, the history of early attempts to cultivate epiphytic orchids under glass, and also gives notes on the early cultivation of palms and succulents, with lists of the species grown in his time and the history of individual plants.

Before proceeding to deal with his work on ferns, I must record something of his private life. His tombstone, near the west entrance

PLATE II. John Smith (1798–1888)
(Copyright: Royal Botanic Gardens, Kew)

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to Kew parish church, provides a summary of domestic tragedy. Of six children, only two survived childhood, and their mother died at the age of 35. The only son, a promising boy who was appointed to take charge of the museums at Kew, had to cease work at the age of 25 owing to ill-health, and died at 33; the last surviving daughter died at the age of 42. John Smith outlived them all, and though blind occupied his last years in writing a series of books which showed the wide range of his knowledge and interests. He also left an extensive manuscript history of Kew, in which some of his private grievances are more fully expressed. He died at Kew on 12 February 1888.

John Smith records that when he went to Kew there were about 40 species of ferns in cultivation. Fifteen years later there must have been a considerable collection of tropical species, as shown by some of the drawings made by Francis Bauer (artist at Kew from 1790 to 1840) which were the basis of Hooker's *Genera Filicum* (1838–1842), to which I will revert later. After Hooker's appointment as Director at Kew he began his great work *Species Filicum*, covering all known species of ferns, the publication of which occupied twenty years (1844–1864); during this period the number of ferns in cultivation greatly increased. John Smith published a list of almost 400 species living in December 1845. His next published list was in 1857, and included all those known to be in cultivation, the number being 600. In his book *Ferns, British and Foreign* (1866) he enumerated 1084 species which he had seen alive.

A study of Smith's successive lists indicates the development of his thought on the inter-relationship of ferns and thus on classification. His first important publication was in 1841–43, in Hooker's *Journal of Botany*, vol. 2, " An arrangement and the definition of the genera of ferns, with observations on the affinities of each genus ". He records that he had long thought about the subject, and had come to the conclusion that venation and other vegetative characters should be used in the definition of fern-genera (mentioning the influence of Robert Brown's stray comments on this subject), and that when PRESL's *Tentamen Pteridographiae* (1836) came into his hands he found much agreement between his ideas and Presl's. Prior to this, the shape and position of the sorus and of its indusium were the sole characters admitted in definition of genera. John Smith saw that this brought together species which, as judged by the whole structure of the plant, were not at all nearly related (for example, *Polypodium* and *Phegopteris*). His successive schemes show an increasing insight, and mark an important contribution to thought on the subject, thought that received insufficient recognition owing to Hooker's reactionary attitude. In *Species Filicum*, and in the later summary entitled *Synopsis Filicum*, Hooker reverted to the crudely artificial concept of genera, and for half

a century these great works were the only books covering all ferns in the world.

In the introductory part of Smith's last book on ferns (*Historia Filicum*, 1875) he stated: " the living collection, requiring daily care and attention, led me to become acquainted with the special habits and modes of growth of the different species; and this has enabled me to draw up the following natural arrangement ". He went on to disclaim finality; but it is undoubtedly true that his scheme was in advance of any produced until more than fifty years later. We may also note here W. J. Hooker's generous tribute to John Smith, in the introduction to *Synopsis Filicum* (1865), written shortly before Hooker's death. In referring to the living collection of ferns at Kew, he wrote that it was the finest in cultivation, and " the formation of this fine collection is mainly due to the exertions and ability of Mr John Smith, who for 43 years held an important position among the officers of the Royal Gardens. His knowledge of ferns, and his writings on them, justly entitle him to rank among the most distinguished pteridologists of the present day ".

A number of the illustrations in Hooker's *Genera Filicum* (1838–42) are accompanied by names and latin generic diagnoses provided by John Smith, who had studied the plants in question and had evidently provided material of them for the artist. Some were drawn from living plants, some from herbarium specimens; among the latter are representatives of Hugh Cuming's collection from the Philippines, which were enumerated by Smith and included a number of genera recognized by him as new. As noted above, Smith's ideas on classification at this time were set forth in his publication of 1841–43. He divided the major family Polypodiaceae into seven tribes, based mainly on soral structure. Within each tribe he had separate sections for genera with free veins and anastomosing veins, except in Pterideae (where the *Pteris* and *Blechnum* sub-groups are distinguished by soral characters) and in Dicksonieae (which included *Lindsaea*, *Davallia* and the filmy ferns). In the tribe Polypodieae Smith still retained *Phegopteris* (including *Gymnocarpium* of current works) with the free-veined *Polypodium* species.

This scheme was improved in the catalogue of 1857, where he incorporated the idea of a distinction between Eremobrya and Desmobrya (two elegant new terms coined by him from the Greek and used by no-one else—he must have had a good grounding in both Latin and Greek). These two terms denoted the distinction between a creeping rhizome the tip of which advances beyond the existing fronds and to which all fronds are jointed (e.g. *Polypodium*) and a rhizome or caudex of which the apex does not advance beyond existing fronds,

the fronds not being jointed to it. In 1857 only *Polypodium* and its immediate allies were included in Eremobrya.

The scheme of 1857 was developed further in *Ferns, British and Foreign* (1866), with explanatory notes and illustrations. Here Eremobrya is made to include not only the whole *Polypodium* group of ferns (Polypodiaceae in the strict sense of modern works but omitting *Platycerium*) with both free and anastomosing veins, but also the *Davallia* group and *Oleandra*. In Desmobrya there is a tribe Phegopterideae which includes all Thelypteroid and Dryopteroid ferns, whether indusiate or not (but it includes also *Nephrolepis*). Hymenophyllaceae is recognized as a distinct family, of equal rank to Polypodiaceae, though Cyatheae and Dicksonieae are still ranked as tribes within Polypodiaceae.

The final scheme of *Historia Filicum* (1875) gives the same content to Eremobrya and Desmobrya, but in the former there is some further subdivision of the *Polypodium* group and *Platycerium* is included. Desmobrya is divided into a larger number of tribes; for example Blechneae and Adianteae are separated from Pterideae. Gleichenieae, Hymenophylleae, Schizaeae and Osmundeae are all ranked as tribes of Polypodiaceae, which thus comprises all Leptosporangiate ferns, a quite logical arrangement. The introduction to this book gives a careful survey of the history of classification, and is well worth study by modern pteridologists.

The contemporary author whose ideas most nearly resembled John Smith's was Mettenius (1823–1866) of Leipzig. Mettenius made very careful anatomical and morphological studies of many kinds, and was more attentive to the details of scales and hairs than any other author for the next fifty years. Had Mettenius lived (he died of cholera at the early age of 43) it is certain that he would have altered the history of pteridological thought. His only completed scheme of classification, dated 1856 (in *Filices Horti Botanici Lipsiensis*) is much on the same lines as Smith's, but the later arrangements of Smith are certainly an improvement. Neither author made a good subdivision of the great mass of terrestrial ferns included by Smith in Phegopterideae; this had to wait for Christensen (1912–1919) and subsequent authors, and indeed the problem is not yet solved.

John Smith was a man of intense industry. He not unnaturally had a sense of grievance when his work was undone by the plans of those in authority over him, and this is shown in his manuscript record; it is clear that in many cases his special knowledge was disregarded. To his subordinates he was probably a severe master, but evidently at least two of them (whom he mentions by name) had received sufficient inspiration from him to help him in making records after

his sight failed. Mr Desmond reports a statement by Botting Hemsley that Smith "was not of a sympathetic nature . . . he required no relaxation himself . . . and gauged others' needs by his own". This statement should be read in conjunction with the testimony of W. J. Hooker of the excellence of John Smith's services to Kew. Looking back, we can see him as a man with both originality of mind and also a strong sense of duty; Kew may well hold him in honour and remember his many services with gratitude.

REVIEW

THE OXFORD BOOK OF FLOWERLESS PLANTS. Text by F. H. Brightman, illustrations by B. Y. Nicholson, pp. viii + 208, Oxford University Press, 1966 price £2.5.0. 25 × 18cm

This book illustrates in vivid colour almost 690 species of pteridophytes, bryophytes, lichens, fungi and marine algae with its main aim "to help the beginner with identification". Short descriptive notes are given opposite the drawings with the same aim in view and in many instances mention is made of closely related species not illustrated. To facilitate the use of the book the species are not grouped in systematic order but in habitats under the following main headings: seashore, grasslands, uplands, wet places and woodlands; each of these is subdivided so as to be more precise a guide. The plants are put into perspective in a note on their classification at the end of the book.

Twenty-four genera comprising 41 species of ferns or "fern allies" are illustrated. The polystichums (p. 187) are characteristic but the erect habit of *Dryopteris carthusiana* is lost in the composition of the page; the obtuse mucronate teeth of *Dryopteris dilatata* are not well shown in the outlined closeup. The robustness of *Thelypteris limbosperma* (p, 189) is well executed but the detailed drawing does not show the submarginal sori and gives an entirely false impression; *Athyrium filix-femina* on the same page does not show the laceyness of that species. *Dryopteris cristata* (p. 95) is not easily recognisable, and the bent stipe gives a false impression of a creeping, slender rhizome. On the question of colour rendering I think p. 185 is too blue; one useful field distinction is that *Dryopteris aemula* is more yellow green than *D. dilatata* but on pp. 185 and 186 *D. dilata* is far too yellow, and with its gingery scales it resembles *D. assimilus*. The frond of *Asplenium marinum* (p. 1) is too reddish and the shiny black stalk of *Adiantum* on the same page is very poorly represented. On the other hand there are some excellent plates on pp. 57, 95–191. Mr Brightman's comments on the fern species are on the whole good; his differences between *I. lacustris* and *I. echinospora* are not true but this is an isolated and exceptional case. The scale, often only mentioned in the text, is sometimes misleading, e.g. *Athyrium filix-femina* and *Dryopteris filix-mas* are given as having fronds 24 and 18 inches respectively.

But of course this book will not be bought for its ferns alone and it would be unfair to review only that aspect. My criticisms point to where the amateur plant-lover might get misled in those pages dealing with ferns. As a non-specialist of the other 94% of the species described, I find the fungi and the lichens the most fascinating and most rewarding. This is a book not only for the shelf; if bought it will be used.

A. C. JERMY

SPORELINGS OF *EQUISETUM ARVENSE* IN THE WILD

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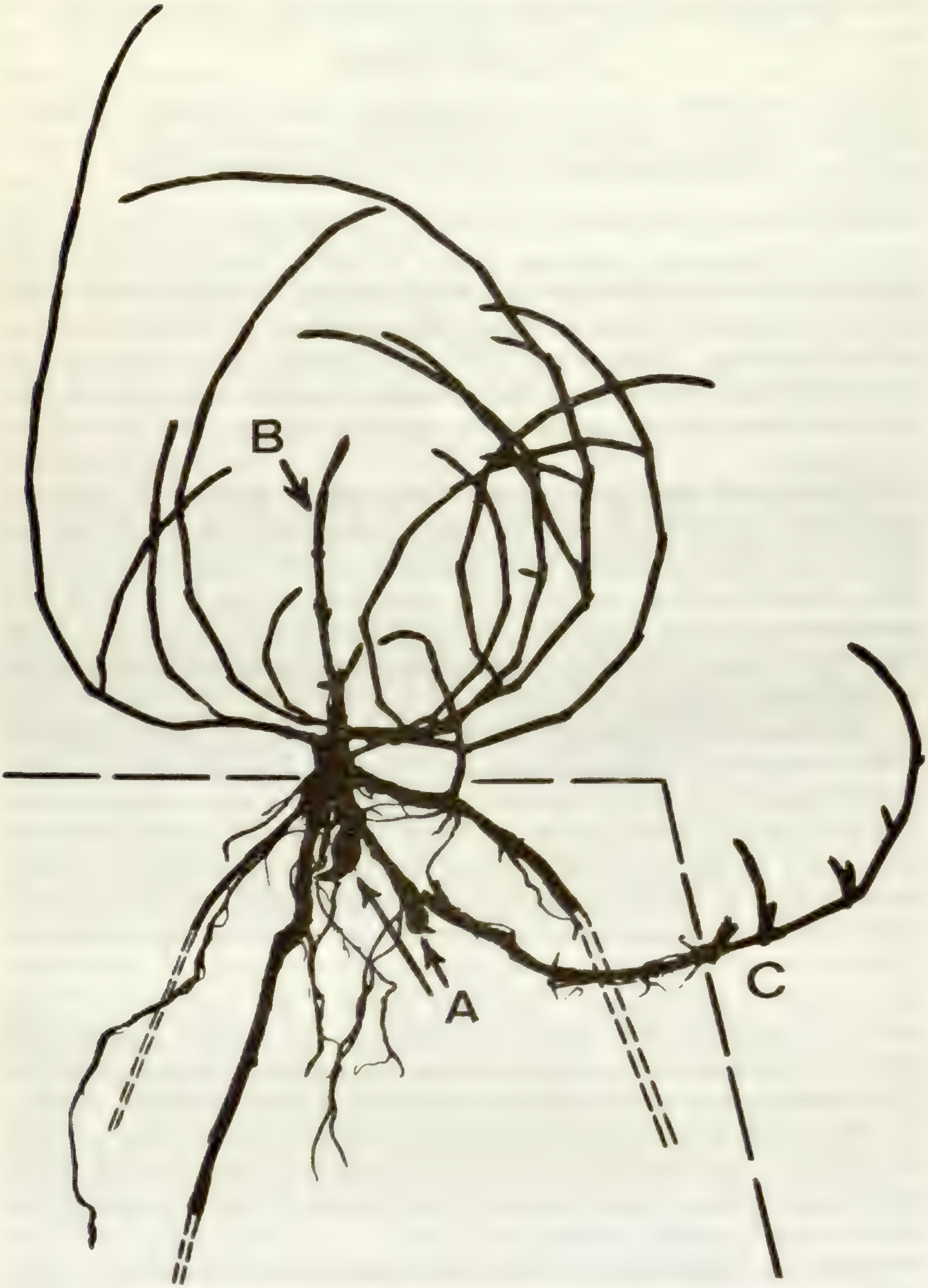
Little is known about the establishment in the wild of the short-lived spores of *Equisetum*, although much is tacitly assumed. Recorded occurrences of wild *Equisetum* prothalli are very few, and observations on the subsequent development of the sporeling plants in nature are virtually lacking. Thus it was with some interest that a large number of small plants of *Equisetum* were recently located which, it was felt, could be demonstrated to represent sporeling plants at the end of their first season.

The plants were growing at Whittle Dene Reservoirs some ten miles west of Newcastle-upon-Tyne, to where my attention was first drawn by Mr O. L. Gilbert in September 1966. The reservoirs had been drained in early April of that year for the construction of new sluice gates, and by September, the damp mud surface which covered most of the reservoir basin was found to be carpeted with small plants of *Equisetum arvense* L.

The reservoir previously had not been drained for thirty years and a fine deep silt of pH 6.2 was now exposed. The silt merged into a muddy gravel of pH 8.5 towards the periphery of the reservoir which was bounded by sloping stone retaining walls extending to some depth above and below the normal water level. Three species of *Juncus*, together with a variety of small annual weeds, were already beginning to establish themselves near the gravel edges. The muddy bottom had shrunk as it consolidated and had developed a network of deep cracks, although the surface had remained damp. The presence of large shells of the freshwater mussel *Anodonta* in the muddy bottom right up to the flanking walls confirmed that the whole of the reservoir had been continuously covered for many years by a good depth of water.

The *Equisetum* plants were already well established, and carpeted the whole of the bottom of the empty reservoir, often a dozen plants to the square foot. Each formed a loose rosette of three to eight simple or sparsely branched decumbent shoots, 4 to 14 cm long and 1 mm diameter, no particular shoot dominating over the others. Only occasional plants had developed their first leader shoot, which grew more or less erect, up to 20 cm tall, and 5-sided. These bore several regular whorls of five short 4-sided branches. Each plant examined had produced between two and five rhizomes varying from 2.5 to 35 cm in length, and 1.2 to 1.5 mm in diameter. These penetrated the mud at a steep angle, only occasionally producing a lateral branch rhizome.



Silhouette of sporeling ***E. arvense*** gathered in early September. Large broken-line indicates position of soil and fissure surfaces. A) tubers, B) leader-shoot developing, C) shoot developed from a rhizome which penetrated a fissure. A small lateral shoot also emerges from the first node of the uppermost rhizome. Natural size.

Where, however, the rhizome struck the surface of a deep fissure a single 4-sided aerial shoot was often produced. The rhizome internodes, which were white or pinkish in colour, varied in length from 1.2 cm close to the aerial rosette, and increased to 2.5 cm at some distance from it. Unlike those of the aerial shoot, each rhizome internode became fully extended immediately behind the apex. Regular whorls of four or five long slender unbranched roots originated from almost every underground node. Larger roots occasionally could be found which bore simple laterals at frequent and irregular intervals. The young rhizomes usually grew downward to a depth of at least 20 cm before starting to level off, and their roots penetrated to 25 or 30 cm below the soil surface.

By early November the plants were still green and had grown to form bushy tufts about 30 cm across, with up to two dozen shoots. Some of these sparsely branched semi-decumbent aerial parts reached a length of 25 cm and had up to fifteen nodes. Many plants had developed, at the end of only their first season, three to five small solitary oval tubers from some of the older rhizome nodes just beneath the mud surface.

MATZKE (1941) found gametophytes of *Equisetum arvense* growing under very similar conditions to those pertaining here, in the bottom of an old iron-ore mine which had been flooded and redrained. By mid-June these prothalli had produced small sporophytes, and some of the largest gametophytes had already begun to break down. FEIGLEY (1949) recorded prothalli of *E. scirpoides* Michx growing on the compact soil of the vertical walls of a roadside ditch. She noted that small sporophytes were developing at the expense of the gametophytes, the tissue of the prothalli becoming reduced in direct proportion to the number and vigour of the sporophytes upon it. Despite the slim possibility therefore of prothalli having survived together with the sporophytes to September at Whittle Dene, a careful search was made for them. Neither prothalli nor the remains of any vegetative fragments were found, but when all the evidence is considered there can be little doubt that the plants had arisen in this instance from spores, and not from the breaking up and dispersal of vegetative parental material. Were vegetative propagation the case a multitude of such nodal fragments would have been required to have produced the extremely large numbers of young plants observed. Furthermore, these pieces would have had to have been available for uniform dispersal over the reservoir by the water before it was completely drained off in early April. At that time of the year, aerial shoots of *E. arvense* are not in evidence in Northumberland and therefore could not have been available to provide a source of fragments in this manner. Similarly, the stone retaining walls of the reservoir would have minim-

ised, if not totally prevented, fragmentation of any rhizome material into the water, and no other source from which such abundant pieces of rhizome as would have been required, could be found.* On the other hand, very shortly after the reservoir had been drained, many colonies of *Equisetum arvense* in the surrounding area are known to have been shedding their spores.

From the available evidence it is concluded, therefore, that these hundreds of horsetails clothing the bottom of the reservoir had arisen as the result of the successful establishment of spores earlier in the year. The wet mud surface exposed by the retreating water formed a virgin habitat free from the competition of established plants, and hence immediately available for the germination and development of the short-lived green *Equisetum* spores being shed in great abundance nearby. It is therefore believed that under these apparently ideal conditions the prothalli would have developed vigorously, soon producing these young sporelings. Matzke and Feigley both record that commonly more than one sporophyte was produced on each prothallus, but judging by the distance of several inches between most of the present plants, one sporophyte only must have ultimately arisen from each prothallus, and unless there were initially a great many more prothalli than even the present number of sporophytes would lead us to believe, most must have arisen as the result of self-fertilisation.

By the end of their first season these plants dominated the habitat with nearly 100% cover over the surface, and an impressive development of roots and rhizomes beneath it. Had the reservoir not been re-flooded, there is every reason to believe that they would have been permanently established, and that the *Equisetum arvense* had very effectively pioneered this new bare habitat.

I would like to thank Dr T. G. Walker for his help in the preparation of this paper.

REFERENCES

FEIGLEY, MARGARET, 1949. An occurrence of gametophytes of Equisetum in Cheboygan County, Michigan. *Am. Fern Journ.* 39: 106–109.

MATZKE, E. B. 1941. Gametophytes of Equisetum arvense L. *Torreya* 41: 181–187.

*The water is screened of all such debris before entering the reservoir.

BOOK NOTE

INDEX SELAGINELLARUM by Clyde F. Reed (*Mem. Soc. Brot. 18. 1966*). Dedicated to A. H. G. Alston and based on his manuscript index, it was inevitable that the major part of Reed's Index is Alston's. Comparison reveals what a mammoth task of editing has been done and also how many of Alston's somewhat enigmatic idiosyncracies have been included. One could wish there had been consultation between Dr Reed and the BMNH to attain a clearer transcript and format, but understandably he probably feared serious delay. As it is, we have a long-wanted index and nomenclator, even though finding the answers may sometimes require dexterous and inspired rummaging among its 287 pages.

J. A. CRABBE

GRAMMITIS IN SAMOA

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Species of *Grammitis* are all small ferns with simple, entire fronds and naked sori. They commonly grow epiphytically in rain forest or mist forest usually at considerable altitudes and are world wide in distribution within the tropics or subtropical regions to which they are almost wholly confined. They are rarely if ever seen in fern houses and are reputed to be almost impossible to grow in cultivation.

Seven species of *Grammitis* are included in CHRISTENSEN's " Revision of the Pteridophyta of Samoa " *Bull. Bishop Mus.* 177:1–138, 1943). In this monographic account of the genus (in *Philip. Journ. Sci.* 80: 93–271, 1952) COPELAND attributed eight species to Samoa. The Society Islands are credited with five species, Hawaii with four, Fiji with three and New Caledonia with three. Copeland considered the number of species present in Samoa to be " most remarkable " and he adds that the paucity of collections from there is also remarkable. This is certainly born out by the fact that the most frequently collected species of *Grammitis* in Samoa is not known to have been collected more than half a dozen times; other species are known from one, two or three collections only. Part of the reason for the small number of collections of these Samoan ferns is connected with their being inconspicuous plants which are largely confined to the mountain forests in the most inaccessible regions of the interior. But part of the reason is also due to the fact that all the species in Samoa appear to be remarkably localised. One may see several specimens of a *Grammitis* growing epiphytically on a tree trunk and search neighbouring trunks in vain for further specimens; indeed the rest of the day may be spent in traversing mossy forest rich in ferns and apparently ideally suited for species of *Grammitis* without another specimen being seen.

During 3 months' fern hunting in Samoa in 1965 I was fortunate to find all the species of *Grammitis* though only two species were collected on more than one occasion. As would be expected in a group which favours high level rain forests, the island of Savaii which has the highest mountains is richest in species. Four species of *Grammitis* on present evidence would appear to be confined to Savaii. The lowest altitude at which I encountered any species was 2000 ft.

Since Christensen and Copeland were dependent for their accounts on herbarium material, much of it both old and somewhat scanty, it is scarcely surprising that the improved knowledge of these little known Samoan ferns which my collections have afforded has necessitated some revision of the previous accounts. One of Copeland's species is here

reduced to a synonym but as one new species is described the total number of Samoan species remains unchanged.

The missionaries Powell and Whitmee who collected ferns assiduously in Samoa nearly a century ago unfortunately rarely cited localities whence their specimens had been gathered. Information about distribution within Samoa is therefore scanty and I have not thought it necessary to repeat the information which is already given by Christensen in his fern flora of the islands. Specimens of all my gatherings have been deposited at Kew.

The following key, modified from those given by Christensen and Copeland, will serve to distinguish the species.

Fronds with black margins .. .. .. 1. *G. vaupelii*
Fronds lacking black margins:
  Stipe glabrous .. .. 2. *G. graminella*
  Stipe hairy:
    Sori near the midrib:
      Sori immersed in deep craters .. .. 3. *G. insularis*
      Sori superficial or slightly immersed:
        Marginal hairs over 1 mm. long:
          Fronds glabrous above save on costa 4. *G. monticola*
          Fronds hairy above .. .. .. 5. *G. hookeri*
        Marginal hairs very short .. .. 6. *G. conformis*
    Sori medial to supramedial:
      Sori in a regular submarginal row .. 7. *G. whitmeei*
      Sori irregularly biseriate or scattered .. 8. *G. samoensis*

1 GRAMMITIS VAUPELII (Brause) Copel., in Philip. J. Sci. 80: 265 (1952)

Polypodium Vaupelii Brause, Notizbl. Bot. Gart. Berlin 8: 140 (1922)

P. marginellum Baker in J. Bot. Lond. 14: 12 (1876) non Swartz (1788).

My single gathering of this—three specimens and only one frond fertile—is only the fourth known collection, all of them from the island of Savaii. The fronds are very narrow, up to 17 cm long and 2–3 mm wide.

I have seen no specimen of *P. marginelloides* J. W. Moore from Tahiti, which Copeland thought probably the same species. It has wider fronds (7 mm) and is said to have forked glandular hairs on the frond margins which is not the case in my Samoan plants.

SAVAII: epiphytic in mossy forest, Maugaloa, alt. 1050–1200 m, 6 March 1965. *Sledge 1738.*

2 **GRAMMITIS GRAMINELLA** (C. Chr.) Sledge **comb. nov.**

Polypodium graminellum C. Chr., Index Fil. 530 (1906). Bull.

Bishop Mus. 177: 108 (1943).

P. simplex Baker in J. Bot. Lond. 14: 12 (1876) non Sw. (1801).

P. ligulatum sensu Hieronymus in Hedwigia 44: 78 (1905) non Bak. (1867).

Grammitis ligulata sensu Ching in Bull. Fan Mem. Inst. Biol. Bot. 10: 240 (1941); sensu Copel. in Philip. J. Sci. 80 (2): 150 (1952) non *Polypodium ligulatum* Bak. (1867).

This is the fern which Hieronymus and Copeland considered the same as Baker's *Polypodium ligulatum*, a supposedly Fijian species based on a gathering by Brackenridge. Both authors used Baker's epithet for Samoan plants. But the identity of Baker's species had never been settled by reference to the type and when Copeland wrote to Alston asking him to look into the matter the reply he received stated (*loc. cit.* 151) that " he found at Kew only an empty cover bearing the name *Polypodium ligulatum* ". Yet if Alston had looked a little further he would have found the specimen, and just where one would expect to find it, i.e. amongst the specimens which Brackenridge sent to Hooker as his *P. conforme*.

No doubt later authors, in trying to place Baker's species, have been troubled by the fact that no known Fijian *Grammitis* would agree with Baker's description. But Copeland has pointed out (*loc. cit.* 150–151) that localities were " of very minor importance to Brackenridge who in publication and distribution gave one number to what he regarded as a species no matter how far apart the specimens were collected ". This judgment is certainly born out by *Grammitis ligulata* (Bak.) Ching which Baker founded (Syn. Fil.: 320) on a specimen of Brackenridge's sent as *P. conforme*. This is one of three specimens mounted on one sheet, two of which have setose stipes and short marginal hairs on the fronds, and are *G. conformis*. The third specimen is glabrous and has narrower, longer and thinner fronds. Two specimens adjacent to one another on the sheet had already been annotated by Hooker " more like *P. subspathulatum* Brack. Tab. I f. 1 " and this note is followed by " = *P. ligulatum* Syn. Fil " in Baker's writing.

It is evident therefore that Baker founded his new species on two specimens one of which was typical *G. conformis*. His description however, save for one statement, could only have been drawn up from the glabrous plant which must therefore be the holotype of *G. ligulata* (Bak.) Ching. In describing the texture of the fronds as " subcoriaceous " Baker must have been in some difficulty since the glabrous plant had herbaceous fronds with the veins clearly evident whilst the *conformis* specimen had stiff, opaque fronds with hidden veins. It may be noted that Baker adds, after his description of *P. ligulatum* " Like the preceding but the texture thinner ". The preceding was *P. pseudogrammitis* the fronds of which are also described as subcoriaceous! This type specimen of *Polypodium ligulatum* Baker, purporting to have come from Fiji is in fact identical, not with any Fijian or Samoan *Grammitis*, but with the species which Mettenius described, from specimens collected on Tahiti, as *P. trachycarpum*, two years after

Baker had—inadequately and in one respect misleadingly—described the same species from a single specimen which Brackenridge had almost certainly collected in Tahiti but had failed to distinguish from his *P. conforme*.

Baker's *Polypodium simplex* was founded on *Whitmee 123 ex parte* and the Kew sheets of this gathering and *Powell 192*, which is manifestly identical, carry thirteen good specimens. My own gathering agrees exactly with Whitmee's and Powell's specimens.

Christensen states that the sporangia of *G. graminella* are glabrous but Copeland describes them as " bearing minute, dark-chestnut setulae ". Copeland's description is correct. On the other hand Copeland's reference (*loc. cit.* 151) to the paleae on one gathering as " bearing 2 or 3 unicellular hairs at the tip " is inexplicable. Hairs are never present on the scales of *G. graminella*. I have examined under the binocular microscope all the Kew specimens of this species and every one of my own and the paleae are uniformly naked. Indeed of all Samoan species of *Grammitis* only in *G. samoensis* are the paleae provided with long apical hairs, sometimes solitary but often two or three together, at their tips. Copeland's observation was therefore, if accurate, made on a specimen which was certainly not *G. graminella* but could well have been an aberrant *G. samoensis*.

It was evidently on account of this observation that Copeland placed *G. graminella* next to *G. samoensis* in his monograph. In other respects he considered it " not very near " to that species. I see no relationship whatever between them. The affinity is clearly with the plant from the Society Islands which has for so long been called *G. trachycarpa* but for which the name *G. ligulata* must now be substituted. In his key to the Pacific Island species (*loc. cit.* 140–141) Copeland uses the herbaceous versus the subcoriaceous texture of the fronds as the character whereby to separate *G. trachycarpa* from *G. graminella*. Doubtless if he had not been misled by Baker's false statement he would long ago have referred *P. ligulatum* to the former species and not to the latter. The rather stiff texture and opaqueness of the fronds of Samoan plants is just as constant as is the thin texture of Tahitian plants in which the fronds also have a greater tendency to be repand but in other respects I see no significant differences.

SAVAII: epiphytic in mossy forest, Maugaloa, 990 m, 4 March 1965. *Sledge 1722.*

3 GRAMMITIS INSULARIS Copel., in Univ. Calif. Publ. Bot. 18: 223 (1942); Philip. J. Sci. 80: 149 (1952).

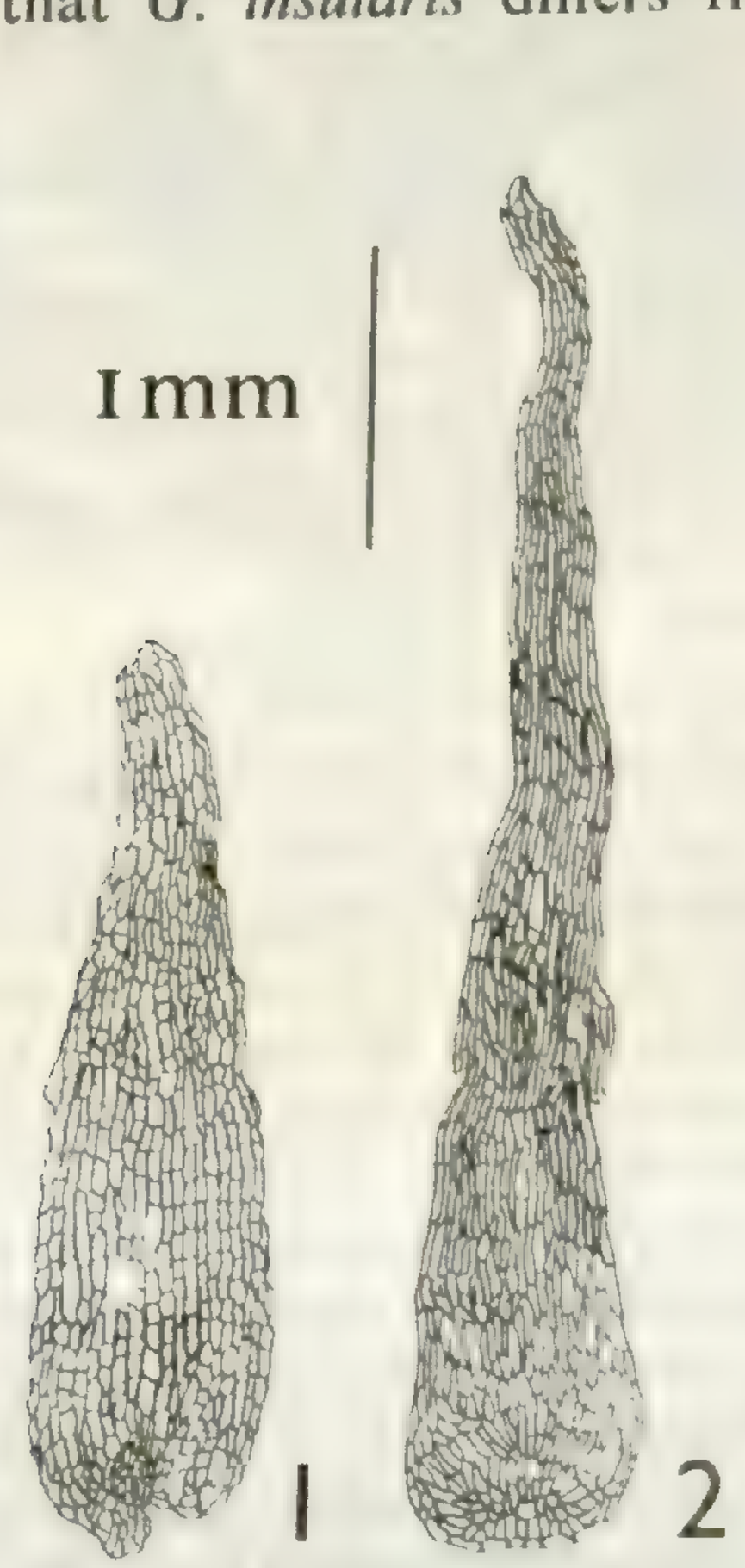
Polypodium subspathulatum Brack., var.? sensu C. Chr., in Bull. Bishop Mus. 177: 108 (1943).

This was based on *Vaupel 451* collected from " Hinterland Maugaloa " on 27 March 1906 and distributed by Vaupel as *P. conforme*. Neither Whitmee nor Powell appear to have found this species and no other gathering was known until my two collections both made in Savaii and one of them in forest near Maugaloa. Christensen cites the

Berlin label of *Vaupel* 451 as from " Mataana 1600 m, epiphyte ". (Mataana and Maugaloa are both volcanic cones situated about three miles apart on the eastern side of central Savaii). Copeland states that the Vaupel collection " is uncited by Christensen " when in fact it is cited and under the species where one would expect to find it cited. Christensen in fact pointed out the differences between the Samoan plant and *P. subspathulatum*, which was described from the Society Islands, but refrained from naming it since he had seen " only one rather old plant ".

This is easily separated from all other Samoan species of *Grammitis* by the deeply sunken sori. Copeland describes the fronds as up to 17 cm long. The largest on my gatherings is 26 cm and the normal width of fronds is 8–10 mm. The arrangement of the veins and sori are well shown in Copeland's fig. 21, the sori being situated fairly low down on an unbranched acroscopic branch vein which terminates about half way between costa and frond margin. The basiscopic branch forks at about the level of the ending of the acroscopic branch, and their endings are situated just within the margins of the frond. On the upper surface of the frond all the vein endings appear as conspicuous punctate markings and hence within each margin there is a row of dots and another row of dots but only half as numerous occurs about midway between costa and margin.

Copeland states that *G. insularis* differs from *G. subspathulata*



FIGURES 1 & 2 Rhizome scales of *Grammitis:* 1) *G. hookeri*, 2) *G. monticola*

in "the inframedial sori, more naked fronds and paleae". The venation is also distinctive as a comparison of his fig. 21 (*G. insularis*) and fig. 26 (*G. subspathulata*) shows. The sori differ not only in position in the two species but those in *G. insularis* are sunk in deeper craters. As regards the "more naked fronds" of *G. insularis* there are certainly very few marginal hairs on the type specimens but marginal and surface hairs are fragile and easily abraded in old fronds. My own specimens show that moderate numbers of hairs are distributed along the margins much as in *G. subspathulata*. I see no difference in the scales of the two species. Although Copeland claims that these afford one of the specific distinctions he does not state what the differences are nor are these indicated in his descriptions under the two species where the scales are referred to in virtually identical terms.

SAVAII: epiphytic in mossy forest, Maugaloa, 1200 m, 6 March 1965. *Sledge 1739.* Epiphytic in mossy forest, Tuisivi Range above Aopo, 1350 m, 17 March 1965. *Sledge 1797.*

4 GRAMMITIS MONTICOLA Sledge sp. nov. PLATE III

Rhizoma breve, crassum, paleis rufo-brunneis, lineari-lanceolatis, acutis, 4–5 mm longis munitum (FIG. 2). Frondes approximatae, fasciculatae; stipitum longitudo inconstans usque ad 2 cm longa, pilis castaneis, squarrosis, 2–3 mm longis ornatum. Lamina usque ad 20 cm longa, 1–1.5 cm lata, rigide herbacea, elastica, integra, aliquantum repanda, costae utrinque marginesque cum pilis 2 mm longis stipitibus similes alibi paginae glabrae; venae manifestae bis, raro ter, furcatae, in parte superiore simplices, ramus fertilis acroscopicus plus minus supra sorum prolongatus, ramus sterilis basiscopicus circa extremum rami acroscopici furcatus, aliquando una eius divisionum denuo furcata. Sori uniseriati superficiales prope coasta setis paucis longis circumdatis; receptacula elongata sed orbiculascentia, sporangia setulis minutis brunneis munita.

Differt a *G. hookeri* statura maiore, paleis longioribus, fuscioribus, acutioribus et pilarum superficialium in frondibus deficientia.

Rhizome short, thick, covered in red-brown, linear-lanceolate, acute scales, 4–5 mm long (see FIG. 2). Fronds clustered close together; stipes variable in length up to 2 cm, with chestnut-brown, squarrose hairs 2–3 mm long. Lamina up to 20 cm long, 1–1.5 cm broad, stiffly herbaceous, elastic, entire, somewhat repand at margins and costas both above and below with hairs 2 mm long, similar to those on the stipe, the surfaces elsewhere glabrous; veins obvious, twice, rarely three-times, forked, simple in the upper part, the fertile branch acroscopic, more or less extended beyond the sorus, the sterile branch basiscopic, forked about the level of the ending of the acroscopic branch, sometimes one of its divisions forking again. Sori superficial in one row near the costa, surrounded by a few long setae; receptacle elongate but becoming orbicular; sporangia with minute brown setulae.

PLATE III. *Grammitis monticola* Sledge

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HOLOTYPUS, UPOLU: epiphytic, summit ridge of Mt. Fito, alt. 1080 m, 2 April 1965. *Sledge 1835* (K).

Very different from any other Samoan *Grammitis*. It is one of the *hookeri-conformis* group of species and most closely related to the former species from which it differs in its larger size, longer and darker scales (see FIGS. 1 & 2) and in the absence of hairs (other than paraphyses) on the faces of the fronds. I have seen two Samoan gatherings referred to by Copeland (in Philip. J. Sci. 80: 143 (1952)) under *G. wattsii*. They are not the same as this species and I agree with Copeland in referring them to *G. hookeri*.

5 GRAMMITIS HOOKERI (Brack.) Copel., in Philip. J. Sci. 80: 157 (1952).

Polypodium hookeri Brack., U.S. Expl. Exped. 16: 4 (1854).

P. setigerum Hook. & Arnott, Bot. Beech. Voy.: 103 pl. 21A (1832) non Blume (1828).

This is the most widely distributed of the Samoan species of *Grammitis*, occurring also in Hawaii, whence the type was described, and Fiji. Records from elsewhere are not accepted by Copeland. Within Samoa it is evidently very rare as stated by Christensen. I collected it once only. The two specimens of this collection match well the type gathering of *P. setigerum* from Hawaii.

There is one Samoan collection by Powell in the Herbarium of the British Museum not referred to by Christensen. The only Samoan gathering at Kew is a single specimen from Tutuila without the collector's name.

SAVAII: epiphytic in mossy forest, Tuisivi Range above Aopo, alt. 1350–1500 m, 17 March 1965. *Sledge 1806*.

6 GRAMMITIS CONFORMIS (Brack.) J. Sm., Hist. Fil. 181 (1875). Copel. in Philip. J. Sci. 80: 147 (1952).

Polypodium conforme Brack., U.S. Expl. Exped. 16: 4, pl. 1 fig. 2 (1854); C. Chr. in Bull. Bishop Mus. 177: 109 (1943).

Grammitis christophersenii Copel., in Occ. Pap. Bishop Mus. 15: 89, fig. 8 (1939). Philip. J. Sci. 80: 147 (1952).

The type sheet (U.S. Nat. Herb. 60714) carries two somewhat dissimilar and damaged specimens. These have been described by Copeland (*loc. cit.*) but he was incorrect in his guess that they represented "probably the entire collection", for three specimens bearing the same label as the type sheet were sent to Hooker and are in the Kew collection. The three Kew specimens are also not uniform; two of them are *G. conformis*, the third is a glabrous plant which was subsequently described by Baker as *Polypodium ligulatum*.

Copeland (*loc. cit.* 148) expressed doubt as to whether Brackenridge's collection of *G. conformis* came from Fiji as stated on the label and he considered a Samoan origin more probable, at least for the smaller of the two specimens on the type sheet. Through the kindness

of Mr C. V. Morton I have been able to examine the type sheet of *G. conformis* and to compare the specimens with those sent to Hooker. The larger plant on the type sheet exceeds in size any of my specimens and—quite apart from the evidence afforded by the specimen of *P. ligulatum* Bak, on the Kew sheet, which in all probability came from Tahiti—I think it improbable that the four other specimens of Brackenridge's *G. conformis* represent a single gathering from one locality; for in my experience different populations of *G. conformis* in Samoa show small differences yet are notably uniform within each local population. Copeland's surmise as to the origin of Brackenridge's specimens of this species could therefore well be correct though *G. conformis* certainly does occur in Fiji; there are two gatherings from there at Kew correctly referred to this species.

I have examined the fragmentary type of *G. christophersenii* in Copeland's herbarium (No. 16411). This differs in no respect from *G. conformis* and Copeland himself evidently had doubts as to its distinctness since, in his later work, he admits that " it is not unlikely that, when better known, they will be found to blend ". The venation characters used to separate the two in his key (*loc. cit.* 147) are not significant since once and twice forked veins may both be present in the same frond of *G. conformis*. Though the fronds of *G. christophersenii* are said to be remarkable for the minuteness and denseness of their marginal setulae, Copeland's illustrations (*loc. cit.*, fig. 19, fig. 20) show no difference whatever in the denseness or length of the marginal hairs in this and *G. conformis*. In his key on p. 141 the two are separated by the colour of their paleae but no reference to this supposed distinction is to be found in the discussion under *G. christophersenii*. I see no difference in scale characters in any of my specimens.

Although the fronds of *G. conformis* are described as glabrous save on the midribs and margins, young fronds are hairy above and a few surface hairs are usually present on the upper side in the lower part of mature fronds and occasional hairs are often to be found elsewhere, at least close to the margins. In one of my gatherings (*Sledge 1696*) hairs are frequent on the upper surfaces of the fronds though in no other respects do the specimens differ from other collections of the same species. The maximum frond dimensions of my specimens are 12 cm long and 6 mm wide. Though the fronds are normally subsessile to shortly stipitate, the stipes may sometimes reach 2 cm in length.

In Samoa this appears to be the most frequent species of *Grammitis*. I collected it in three localities in Upolu and in two in Savaii, whereas of the seven other species I only found *G. insularis* on more than one occasion.

UPOLU: epiphytic in forest on Mt. Fao, alt. 600 m, 17 Feb. 1965. *Sledge 1663*.

Epiphytic in rain forest, Afiamalu, alt. 720 m, 22 Feb. 1965. *Sledge 1679*.

Summit of Sigaele, epiphytic, alt., 780 m, 25 Feb. 1965. *Sledge 1696*.

SAVAII: epiphytic, Matavanu, alt. 600–690 m, 3 March 1965. *Sledge 1710.* Epiphytic in mossy forest, Maugaloa, alt. 1050–1200 m, 6 March 1965. *Sledge 1740.*

7 GRAMMITIS WHITMEEI (Baker) Copel., in Philip. J. Sci. 80 (2): 150 (1952).

Polypodium whitmeei Baker in J. Bot., Lond. 14: 12 (1876). C. Chr., Bull. Bishop Mus. 177: 109 (1943).

Easily recognised by its large size and submarginal sori. The fronds are normally about 20 cm long and often longer and 1–1.5 cm broad. It is apparently confined to the island of Savaii.

SAVAII: epiphytic in mossy forest, Tuisivi Range above Aopo, alt. 1350–1500 m, 17 March 1965. *Sledge 1799.*

8 GRAMMITIS SAMOENSIS (Baker) Ching in Bull. Fan Mem. Inst. Biol. Bot. 10: 241 (1941).

Polypodium samoense Baker, Syn. Fil. 321 (1867); C. Chr., Bull. Bishop Mus. 177: 110 (1943).

P. savaiense Powell in Baker, J. Bot., Lond., 14: 344 (1876).

This is also endemic to the island of Savaii and not related to any other Samoan species. The veins are mostly forked twice with a sorus at the end of the shorter acroscopic branch and of both forks of the basiscopic branch. The sori then appear irregularly biseriate, one row more or less medial in position and the other intramarginal. But frequently one of the basicopic divisions forks again and the sori are then scattered rather than seriate. The linear-lanceolate scales differ from those of other Samoan species in their ciliate margins and in bearing hairs, up to 2 mm or even 3 mm long, at their tips. These are either solitary or, more commonly, two or three are borne together.

Powell's original gathering of *G. samoensis* was made in August 1863. Twelve years later he sent to Baker another gathering which he and Whitmee had made in October 1875 on trees at 4600 ft in Savaii. These specimens are somewhat larger than those of his original gathering and the irregular arrangement of the sori is correspondingly more evident on the broader fronds. Believing it to be a new species he suggested the name *P. savaiensis* to Baker in a note which is attached to the sheet and Baker, accepting Powell's judgement and name, described it as new. There is however no doubt that the two gatherings, each represented by a single sheet at Kew, represent the same species. The distinctive scales are identical in the specimens on both sheets and such differences as exist in the disposition of the sori are simply an expression of the minor differences in frond width in the specimens.

SAVAII: epiphytic in mossy forest, Maugaloa, alt. 1050–1200 m, 6 March 1965. *Sledge 1737.*

I am grateful to Mr C. V. Morton who sent me three type specimens of *Grammitis* from the United States National Herbarium, also to Prof. Warren H. Wagner, Jnr., Ann Arbor, Michigan, for sending me Copeland's type specimen of *G. christophersenii.* I wish also to acknowledge with thanks the grants from the Royal Society and the John Lewis Trust which made possible my visit to Samoa.

THE IDENTITY OF TWO MADAGASCAN SPECIES OF *BLECHNUM*

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Blechnum bakeri C. Chr. is based on a mixture of sterile fronds of this species, sterile and fertile fronds of *B. ivohibense* C. Chr. and of mature and immature fertile fronds of *B. microbasis* (Bak.) C. Chr. A lectotype is chosen for *B. bakeri* and the synonymy and known distribution of *B. bakeri* and *B. ivohibense* are given.

Although CHRISTENSEN (1932) recognised *Blechnum bakeri* C. Chr. and *B. ivohibense* C. Chr. as distinct species, BONAPARTE (1925) and TARDIEU-BLOT (1960) considered the latter to be a variety of the former.

B. bakeri is founded on *Lomaria pubescens* Bak., the type of which was collected at Antananarivo, Madagascar, by Pool. On examination at Kew, this type collection proved to be a mixture of three different taxa on two sheets.

Most of Baker's description of his *L. pubescens* agrees with sterile fronds in this collection with pilose rachises and with pilose veins below; consequently, these fronds have been taken as representing *B. bakeri*. There is also a sterile frond and a fertile frond of *B. ivohibense* as well as a mature fertile and an immature fertile frond of *B. microbasis* (Bak.) C. Chr. in the type collection.

The two sheets forming the type collection of *L. pubescens* Bak. at Kew have been annotated as follows:

Sheet I
- *B. microbasis* (Bak. C. Chr.—fertile frond (A)
- *B. ivohibense* C. Chr.—sterile frond (B)
- *B. bakeri* C. Chr.—sterile fronds (C, D)

Sheet II
- *B. bakeri* C. Chr.—sterile fronds (E, F)
- *B. microbasis* (Bak.) C. Chr.—immature fertile frond (G)
- *B. ivohibense* C. Chr.—fertile frond (H)

In view of the fact that most of Baker's description applies to the pilose sterile fronds of this collection, it is proposed that the specimens annotated C, D in the type collection should constitute the lectotype of *B. bakeri* C. Chr. (*L. pubescens* Bak. non Kunze).

Consequent upon this choice of a lectotype, some discrepancies in Baker's description require explanation. The stipes in the proposed lectotype (though obviously incomplete) vary from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, not 2 to 3 inches as stated by Baker; this can be partly explained by the longer stipes on the specimens of *B. ivohibense* (B, H). Baker's description of the fertile frond appears to have been compounded from the glabrous fertile fronds of *B. ivohibense* and *B. microbasis* in the type collection considering his description of "erecto-patent pinnae, 1–3 inches long".

The type of *B. bakeri* var. *glabrum* is *D'Alleizette 82* from

Mandraka, Madagascar, presumably at Paris, has not been seen but Tardieu's description leaves little doubt as to its identity.

The question now arises as to whether *B. bakeri* and *B. ivohibense* should be regarded as two separate species. The only differences between them appear to be that the rachis and veins are pilose in *B. bakeri* and glabrous in *B. ivohibense*, but no intermediates have been seen as yet. However, both taxa seem to have been collected in close proximity at two localities in Madagascar, at Antananarivo by Pool and on the Pic d'Ivohibe by Humbert. On the other hand, only *B. ivohibense* of this "pair" of species has been collected in continental Africa in widely separated localities in Rhodesia, norther Mozambique and Tanzania. Consequently it seems advisable on the available evidence to treat these two taxa as separate species.

The synonymy and know distribution of these two species is given below.

Blechnum bakeri C. Chr., Ind. Fil.: 151 (1905); Tardieu-Blot in Humbert, Fl. Madag., Polypod. **2**: 7, t.2, f.4 (1960).

Lomaria pubescens Bak. in J. Linn. Soc. Lond. **15**: 415 (1876) non Kunze (1843) nec *Blechnum pubescens* Desv. (1827) nec Hooker (1837). *Blechnum ivohibense* C. Chr. var. *hirsutum* C. Chr. [in Perrier, Cat. Pl. Madag., Pterid.: 44 (1932) *nomen nudum*] in Dansk Bot. Arkiv **7**: 106 (1932).

MADAGASCAR: Antananarivo, *Pool s.n.* (K lectotype; sterile fronds of *L. pubescens*); Forêt de Analamaitso, *Perrier de la Bathie 7625* (BM syntype of *B. ivohibense* var. *hirsutum*); Pic d'Ivohibe (Bara), *Humbert 3299* (BM syntype of *B. ivohibense* var. *hirsutum*).

Blechnum ivohibense C. Chr. in Arch. de Bot., Caen **2,** Bull Mens.: 211 (1928). *Blechnum bakeri* C. Chr. var. *glabrum* R. Bonap. [Not. Ptérid. **16:** 72 (1925) nomen nudum] ex Tardieu in Humbert, loc. cit.: 8, t.2, ff.1–3 (1960). *Blechnum umbrosum* A. Peter in Fedde Rep. Sp. Nov., Beih. **40:** 82, t.3, ff.5–8 (1929).

RHODESIA: INYANGA distr., Pungwe Gorge, *Chase 6659* (BM, K, SRGH), *Schweickerdt 2411* (BM).

MOZAMBIQUE: Namuli, Makua Country, *Last s.n.* (K); Serra do Gúrùe, Marrequelo, R. Namitué, *Mendonça 2162* (BM)

TANZANIA: W. Usambara, *Peter 16489* (BM, K, isotypes of *B. umbrosum*); Uluguru Mtns., Lupanga-Berg, *Schlieben 2959* (BM)

MADAGASCAR: Antananarivo, *Pool s.n.* (K) in part; Pic d'Ivohibe, *Humbert 3300* (BM type of *B. ivohibense*)

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VARIATION IN *ADIANTUM* IN THE BRITISH ISLES

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Perhaps this article is the saddest in this series reviewing variations in British ferns. In the latter half of the nineteenth century, many variants of *A. capillus-veneris* were in cultivation, but alas, so far as the writer is aware none has survived to the present day.

It seems that during the nineteenth century, the British Maidenhair, our only indigenous species of a very large genus which centres on South America grew in many localities in western England, Wales, the Isle of Man, Eire and the Channel Isles. The distribution was maritime, growing in rock fissures and caverns often at sites actually facing the sea, which would suggest a surprising degree of tolerance to saline spray having regard to the thin texture of the pinnae. A fern not reliably hardy, it is of interest that it survived at these localities which experienced the mildest winter climate when the remainder of the country was enduring the very cold winters which occurred during the second half of the 1800's.

Fern hawkers and collectors have been blamed for the decline or elimination of the species from former relative abundance and, judging from the quantity of *A. cuneatum* types which are commercially disposed of today, *A. capillus-veneris* perhaps because of its pleasing colour and delicate form, is still much in demand.

In the BSBI *Atlas of the British Flora* (PERRING & WALTERS, 1962) twenty three 10-km grid squares are marked as possessing the species. There are others, however. In the last few years it has been found at Cheddar Gorge (Somerset), in two localities in Kent, one in Surrey (a score or more plants on a brick wall supporting a railway), and at Whitewebbs Park, Middlesex.

It can frequently be found growing in old mortar walls in greenhouses—especially the supporting walls and footings. The writer has observed it thus growing in Perry's old nursery at Enfield (Middlesex), Stuart Low's nursery at Bush Hill Park, Enfield, both of which now no longer exist, and the Chelsea Botanic Garden (London) where by virtue of the consideration shown towards it by the Curator, it still flourishes; likewise at Hockley (Essex) and in a derilict greenhouse at Swanley (Kent) it has been found growing, but always in the brickwork.

Given the right conditions, and these appear to contain calcium either as natural limestone or mortar, there appears to be no shortage of spores in the air from plants already in cultivation to prevent this

fern from establishing itself. In common with other plants, when growing under adverse conditions the growth is stunted, but fertile fronds are nevertheless produced, even though perhaps only an inch or less long overall and comprising one to three pinnules. Under these conditions the number of pinnules and length of the stipe is affected to a much greater extent than the actual surface area of the lamina compared with a plant growing under better conditions. The rhizome firmly attaches itself to the supporting medium and creeps into any available crevice in the brickwork or rock, thus affording it a degree of protection from inclement weather.

In some of the Royal Horticultural Society Shows at Vincent Square, Westminster, *A. capillus-veneris* has been used in display work staged by municipal authorities and some nurserymen, though it is feared sometimes without knowing what the plant was. The Alpine Garden Society shows occasionally produce a specimen, but the writer has only seen very poorly grown plants with fewer than six fronds.

Although the author has examined carefully every new plant brought to his notice he has never observed anything to suggest deviation from the typical form. As one would expect from different environments changes do occur both in size of frond and pinnules. In cultivation the application of fertilisers does not appear to influence the resulting growth to the same extent as temperature and humidity, and these factors must be borne in mind when assessing a new "find".

As one might expect E. J. Lowe developing his "multiple parentage" theory, did more work endeavouring to raise new forms of this species than any other person and was most eminently successful, as demonstrated by the number (in excess of fifteen) of his cultivars which received First Class Certificate awards from the Royal Horticultural Society or Royal Botanical Society between 1868 and 1872.

Of the many wild finds in this country, that of *A. capillus-veneris* var. 'Cornubiense Moore' (Hayle, Cornwall, 1868) must have been outstanding and one of the few recorded for posterity by its inclusion in the nature prints at the end of CHARLES DRUERY'S *British Ferns and their Varieties*. The print shows a frond bearing many very deeply cut pinnules. The measurement given is one foot two inches, and this presumably refers to the overall length; it must have been a very impressive plant. The extensive cutting of the pinnules suggests a high degree of sterility, but the fact that further varieties were raised from it clearly establishes that it was capable of producing viable spores. That there was more than one locality for this particular variety would seem to be established by a note in *Gardeners' Chronicle* 1877:467, which mentions that it was known from elsewhere than Hayle. In *British Ferns and where found* (E. J. LOWE, 1891, p. 26) it is

described as a large plumose variety, pinnules one inch or more broad and an inch long, deeply divided into ten or twelve narrow fringed divisions, indusium and sori—absent (yet it was fertile!).

Early wild finds also included:

'Incisum Footii'—from Co. Clare, an incised form which looked slightly depauperate
'Magnificum'—Co. Clare, a foliose form
'Padleyi'—from Devon, pinnules concave
'Ramulosum'—another form from Eire which divided several times at the top forming a tuft
'Rotundatum'—from the Isle of Man, having rounded basal pinnules

Forms raised in cultivation, usually from sowings of mixed spores were:

'Admirable', F.C.C. 1871 (FIG. 8*)—large pinnules
'Angustatum', F.C.C. 1872—dwarf fronds "literally covered with young plants"
'Autumnale', R.H.S. Cert. of Merit, 1890—erect, golden tint
'Clorinda' (FIG. 7)—slightly cut pinnules
'Daphnites', F.C.C. 1871—proliferous crowded pinnules
'Digitatum'—fronds unsymmetrical
'Fimbriatum'—pinnules distinctly fimbriate
'Fissum'—pinnules cut into shreds
'Grande'—ultimate pinnules large
'Imbricatum', F.C.C. 1872, Certificated R.H.S. 1886—dwarf and imbricated
'Incisum'—pinnules large and much incised
'Kalon', F.C.C. 1868 (FIG. 9)—very large pinnules, overlapping
'Lowae'—slender pinnules
'Magnificum', Certificated R.H.S. 1869—large and bold
'Multiceps-dentatum' F.C.C. 1872—branching
'Nobile'—golden yellow slender pinnules
'Optandum', F.C.C. 1872 (FIG. 10)—small pinnules widely separated
'Sibyl' (FIG. 11)—incised large pinnules
'Spectabile'—very large and incised pinnules
'Undulatum', Certificated R.H.S. 1869—fronds undulate.

Although the writer has raised several hundreds of plants from spores of the typical form, as previously mentioned, he has not had the good fortune to secure a variant. It seems very strange that none of these plants which were outstanding even in their day, found their way into University and Botanic Gardens throughout the world.

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*The Figures refer to *Fern Growing* by E. J. LOWE, 1898

THE BPS 1966 EXCURSION TO BOVEY TRACEY

J. W. DYCE

" Devonshire lanes . . . The prevalence of the motor in all shapes and forms, from the great chars-a-banc and omnibuses which sweep the sides, to the impetuous cycles which tear up the centres, has revolutionised the roads. No longer do the ferns rise in their beauty attaining the stature and decked with the grace which the climate of Devon can give; everywhere the billhook has been busy—' Make the way clear for the motors ' is the cry, and beauty has to bow before the ' Juggernaut ' of traffic."

Canon H. Kingsmill Moore, 1923, B.F.G. Vol. 5, No. 2.

After a lapse of several years the Annual Excursion was again held in the West County from 10–17 September 1966, centred at Bovey Tracey in South Devon, but gone is the peace and quiet of the country lanes which we were able, only a few years ago, to hunt leisurely without disturbance. Now the holiday-makers are tearing through them in their cars and coaches, and in places it has become quite dangerous to dally over the hedgerow ferns. I wonder what our worthy Canon would say if he could revisit the Devon lanes he walked in 1923!

A smaller number of members* than usual assembled on Saturday, 10th September at the Edgemoor Hotel, situated on high ground about a mile from Bovey Tracey on the way to the moors. It is worthy of record that this hotel is the finest the Society has stayed at during the many years the Secretary has been organising the Excursions since the Second World War. It is beautifully situated in well-wooded country with roads leading from it in several directions, it is very comfortable, well organised, and the food is plentiful and good. The proprietors, Mr. and Mrs. G. S. Kendon, are courteous and helpful, the staff is cheerful and efficient, and we were given every facility to pursue what must have appeared to the other guests eccentric activities. For anyone wishing to visit this lovely part of Devon, we can recommend wholeheartedly the Edgemoor Hotel, Bovey Tracey. For hunting ferns it makes an excellent centre, for they are very plentiful in the vicinity, and even in the Hotel grounds where we found twelve of the more common species.

With recollections of a pre-war visit when magnificent Royal Ferns literally choked the channel of the Dart in the ravine south of Dartmeet, and young plants flourished on every mossy boulder, the Secretary led the party on our first day to this area, but alas! thirty years have

*We were nine in all—Reginald Kaye and Mrs Kaye, Dr Frances M. Jarrett, Mrs J. G. Neilson, H. J. Bruty, Max and Peter Temple, W. Wright and the Secretary. In addition Mrs E. M. Borup was accommodated at the Prestbury Country House Hotel, and Dr James Davidson and Mrs Davidson were staying with their daughter who resides in the neighbourhood. On the Wednesday G. Gilbert arrived for the A.G.M. and stayed for the rest of the week.

wrought big changes. Now the river bed is clear of the ferns, although they still continue to grow abundantly along the banks. We enjoyed the scramble through the ravine although the going was very rough at times. Ferns grew in abundance and most of the common woodland ones were noted as well as some spleenworts on the bridges. Fourteen species were recorded.

Through the courtesy of the Nature Conservancy we were given permission to visit the Nature Reserves in the area, and supplied with maps and information. We availed ourselves of this opportunity to visit three Reserves, Wistman's Wood near Two Bridges, Yarner Wood about a mile from our Hotel, and Bovey Valley Woodlands near Manaton. The Conservancy welcomes visits by specialists and responsible bodies to their Nature Reserves to study the many facets of their natural history, and invites reports and records which can make useful contributions towards the experimental work being carried on in these special areas. Our visits were hurried ones, but we have passed on to the Conservancy our records and observations regarding the ferns.

Wistman's Wood was visited on Monday morning. It lies along the eastern slope of the West Dart valley at a height of 1500/1600 feet about a mile north of Two Bridges from which it is reached by a footpath. The Wood, already regarded as ancient and unusual, early in the 17th century, was established as a Forest Nature Reserve in 1961. At one time the trees were very stunted, heavily branched and festooned with epiphytes, but growth is now more vigorous. Although the trees are not high, really stunted specimens are not so numerous, and the epiphytic growths are reduced. The principal tree is the pedunculate oak. Moss-covered boulders make movement treacherous, but although the rock crevices provide shelter for many ferns, only six species were seen here and we noted *Athyrium filix-femina*, *Blechnum spicant*, *Dryopteris borreri*, *D. dilatata* and *Polypodium vulgare*. Most interesting was the luxuriant growth of *P. vulgare* on the trees, accompanied by *D. dilatata* very much at home in this unusual habitat. *Pteridium aquilinum* was abundant on the open slopes above the Wood.

After lunch we travelled further west to Merrivale, and climbed Cox Tor and Staple Tor. Some years ago in the Gazette (Vol. 8 No. 4) Dr T. D. V. Swinscow described a visit to these Tors and reported finding *Hymenophyllum wilsonii* and *Thelypteris phegopteris*, the Beech Fern. The latter together with the Oak Fern, *Gymnocarpium dryopteris*, is very uncommon in the West Country, and during our many visits since the War to this part of the country we have never been able to include either of these ferns in our records. The opportunity to see *T. phegopteris* therefore, could not be missed, and we were able to

find it on both of the Tors, as well as *H. wilsonii* growing in a most unusual habitat, just as Dr Swinscow described it, in the peaty soil close to the foot of the rocks. Many other ferns were seen in the sheltered corners among the rocks and nine species were recorded. On the way home we made a short stop in the small hamlet of Ponsworthy tucked away in a hollow of the hills. The village walls were full of ferns large and small, but nothing unusual was noted.

On Tuesday we spent most of the day at Yarner Wood Nature Reserve, a very different place from Wistman's Wood, much larger with two streams running through it. The altitude ranges from 275 to 1025 feet with a corresponding range of plant habitats. We devoted most of our time to the lower and wetter parts where ferns flourished abundantly and we recorded twelve species. In spite of hard going through bramble and bog, a scramble along the Yarner Stream was made enjoyable by the magnificent growth of the ferns, and the discovery of *Osmunda regalis* which was flourishing happily in ideal conditions. *Athyrium filix-femina*, *Dryopteris borreri*, *D. filix-mas* and *D. dilatata* were also there, including the hybrid *D. filix-mas* × *borreri*. Throughout the Reserve the dominant fern seemed to be *Blechnum spicant* growing to a size seldom seen, and the variety hunters in the party quickly noted a tendency for the pinnules to be serrate and divided. Another plant was very close to the homophyllous variety *anomalum* Moore in which all the fronds are similar and mostly fertile. Other ferns seen were *Asplenium adiantum-nigrum*, *A. trichomanes*, *Phyllitis scolopendrium* and *Polypodium vulgare*. In places *Pteridium aquilinum* was growing vigorously, and on the higher ground we found *Thelypteris limbosperma*. A fern looked for throughout the week but not seen, was *D. carthusiana*. We were sure we would find it in Yarner Wood for the conditions were right, and we did see some plants which showed possible crossing between *D. dilatata* and *D. carthusiana*. It is very possible that further search will reveal the latter to be present in the Reserve.

A quick look at Becka Falls, a few miles further north, was made before we finished hunting for the day, and this proved most disappointing. Apart from the fact that there are very few ferns there, this " beauty-spot " is very much over-rated.

Our third Nature Reserve—Bovey Valley Woodlands—was visited on the Friday, and this again provided hunting in lush wet conditions which suited the fern population. We expected to see the Royal Fern here, but did not find it, nor did we find *D. carthusiana*, in spite of seemingly ideal requirements for its successful establishment. Only nine species were found, but some of these were in abundance, particularly along the river banks, where *Athyrium filix-femina*, *Dryopteris borreri*, *D. filix-mas*, *D. dilatata* and *Blechnum spicant* flourished along with *Pteridium aquilinum* and also the hybrid *D.*

filix-mas × *borreri*. Other species noted were *Asplenium adiantum-nigrum*, *Polypodium vulgare* and *Thelypteris limbosperma*. The approach to the Reserve from Water is a difficult one down steep wet and overgrown slopes, and this seemed typical of the whole terrain, so that it was impossible in the time at our disposal to cover much of the ground. Our records therefore may not give a true picture of the ferns to be found there.

We emerged from the valley near Manaton, and hunting on the higher ground between Water and Manaton discovered in addition to the species already mentioned, *Asplenium trichomanes*, *Phyllitis scolopendrium* and *Polystichum setiferum*. A quick visit to Manaton Rocks produced very little apart from acres of bracken through which we forced our way with difficulty. Our return journey was through Lustleigh on the opposite side of the river, which entailed quite a hazardous drive across the valley by a very narrow lane—at the very moment when a concentration of Devon's holidaymakers seemed intent on making the same journey in the opposite direction! A brief stop was made by the bridge crossing the Bovey. The map indicates a clapper bridge here, but we did not see it, nor did we find a large variety of ferns. One of the most enjoyable moments of the day was the discovery on a farm wall near Lustleigh of a magnificent colony of *Ceterach officinarum*.

The River Webburn joins the Dart at Holne Chase, and for its last three miles flows through a narrow wooded valley. Two very brief visits in the past by the Secretary, when *Hymenophyllum tunbrigense* had been found in quantity, gave the promise that further hunting would be fruitful, and on the Wednesday we found, with great difficulty, parking space for the cars near the junction of the rivers, and set off up the Webburn valley by a rough path. The low ground was boulder-strewn, with rocky wooded slopes above, and ferns abounded. *Asplenium trichomanes* was noted along with *Phyllitis scolopendrium* and *Polypodium vulgare*. The large-growing ferns were common, *Athyrium filix-femina* large plants in great abundance, *Dryopteris borreri*, *D. filix-mas*, *D. dilatata* and *Pteridium aquilinum*, also *Blechnum spicant*, *Thelypteris limbosperma* and some *Polystichum setiferum*. On the river banks we admired some large plants of *Osmunda regalis*, and further up where the valley narrowed to a shaded ravine, we found *H. tunbrigense* clothing a high perpendicular rock overhanging the water. As there are old records for *H. wilsonii* in the district, we persisted in our search for this seemed to be a suitable habitat, and not far from its relative we found it, although not in such quantity. Again *D. carthusiana* eluded our search despite the presence of plants showing evidence of crossing between this fern and *D. dilatata*.

Sea cliffs are always an attraction, and so, on the Thursday we

travelled south to the Kingsbridge peninsula, with the area between Bolt Head and Bolt Tail as our destination. Leaving the main Salcombe road we paused at Malborough and had a quick hunt while our party assembled. Several wall ferns, *Asplenium adiantum-nigrum*, *A. ruta-muraria*, *A. trichomanes*, *Phyllitis scolopendrium* and *Polypodium vulgare* were seen, but not in great numbers. Narrow lanes with *Phyllitis scolopendrium* on their banks, led us to Bolberry, and down to the coast between Bolberry Down and West Cliff. *Pteridium aquilinum* covered large areas on top of the cliffs, but very few other ferns were found. Some *Athyrium filix-femina*, *Dryopteris filix-mas* and *D. dilatata* were seen, with colonies of *Polypodium vulgare* among the loose stones and in the grass, but our main attraction to the place, *Asplenium billotii*, was abundant in rock crevices, while lower down the cliffs we found *A. marinum* growing vigorously.

On the Saturday morning after an active week, blessed with good weather, a *sine qua non* for our activities, the Excursion ended and we wended our separate ways home with our finds. Several ferns were collected during the week, but very little of great interest apart from the homophyllous *Blechnum spicant*, some crested *Asplenium trichomanes*, a small *Polystichum setiferum* which promises to develop into a cristulate specimen, and *P. setiferum* ' Percristatum ' found on the journey down near Tiverton.

It will be noted how seldom we found *Polystichum setiferum*, and this in the West Country, the " home " of this species. Its epicentre lies further east on the Devon/Dorset/Somerset borders and north to the Brendon and Quantock Hills, and there it is the dominant fern, although in places it can disappear altogether. This disappearance quickly becomes widespread as we move westwards, so that in the Dartmoor area it is quite infrequent and only occasionally did we find it in numbers of more than a few plants. The vicinity of our Hotel was the one place where it was common, and strangely enough its presence here is not recorded in the *Atlas of the British Flora*.

In the following list of ferns seen during the Excursion, figures 1—25 (**bold**=new record, *=confirmation of pre-1930 record, for the *Atlas of the British Flora*) refer to localities:

Asplenium adiantum-nigrum — *3, 4, 5, 8, 10, 11, 13, 15, 16, 17, 18, 25*
A. billotii — **20**
A. marinum — *20*
A. ruta-muraria — *5, 11, 12, 15*
A. trichomanes — *4, 5, 6, 8, 11, 12, 13, 15, 16, 17, 18, 22, 23, 25*
Athyrium filix-femina — *1, 3, 4, 6, 7, 8, 9, 10, 11, 13, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25*
Blechnum spicant — *1, 3, 4, 7, 8, 9, 10, 11, 13, 14, 17, 18, 21, 22, 23, 24, 25*
Ceterach officinarum — *5, 12, 19*
Dryopteris borreri — *1, 3,* **4,** *6, 7, 8, 9, 10, 11, 13, 14, 16,* **17,** *18, 22, 23, 24, 25*
D. dilatata — *1, 3, 4, 6, 7, 8, 9, 10, 11, 13, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25*
D. filix-mas — *1, 3, 4, 6, 7, 8, 10, 11, 13, 14, 16, 17, 18,* **20,** *22, 23, 25*
Hymenophyllum tunbrigense — *23**

H. wilsonii — *7*, *21*, *23**
Osmunda regalis — *9*, *11*, *23*, *25*
Phyllitis scolopendrium — **2,** *4*, *6*, *10*, *11*, *15*, *17*, *18*, *22*, *23*, *25*
Polypodium vulgare *sensu stricto* — *1*, *3*, *14*, *16*, *22*, *23*, *24*, *25*
P. Vulgare *aggregate* — *4*, *5*, *6*, *7*, *8*, *9*, *10*, *13*, *15*, *16*, *17*, *18*, *19*, **20,** *21*
Polystichum setiferum — **8, 10,** *13*, *17*, *22*, **23**
Pteridium aquilinum — *1*, *3*, *4*, *5*, *6*, *7*, *8*, *9*, *10*, *11*, *13*, *14*, *16*, *18*, **20,** *22*, *23*, *24*, *25*
Thelypteris limbosperma — *3**, *8*, *9*, **23, 25**
T. phegopteris — *7*, *21*

	V.C. 3 South Devon (*O.S. 1 in. map ser. 7 sheets 175, 176 and 187*)	Date visited September		National Grid. Ref.
1	Becka Falls	13	20/	7580
2	Bolberry	15		6939
3	Bovey Valley National Nature Reserve ..	16		7680, 7681
4	Cheston, Shute Cross	15		6858
5	Chudleigh Knighton	14		8477
6	Clapper Bridge, River Bovey, near Manaton	16		7582
7	Cox Tor	12		5276, 5376
8	Dartmeet	11		6773
9	Dart Valley between Dartmeet/Holne New Bridge	11		6772, 6773, 6872 6970, 6971, 6972, 7070, 7170
10	Edgemoor Hotel, Bovey Tracey	10–16		7978
11	Holne New Bridge	11		7070, 7170
12	Holne Park, main road near	15		7370
13	Horsham	16		7581
14	Horsham Cleave	16		7581, 7681
15	Malborough	15		7039
16	Manaton	16		7481, 7581
17	Owley	15		6759
18	Ponsworthy	12		7073
19	Sanduck Farm, near Lustleigh	16		7683
20	Slippery Point, near Bolberry	15		6838
21	Staple Tor	12		5375, 5475
22	Water	16		7580
23	Webburn Valley	14		7172, 7173
24	Wistman's Wood Nature Reserve	12		6177
25	Yarner Wood Nature Reserve	13		7778, 7779, 7878, 7879

BOOK NOTE

HELECHOS CULTIVADOS by G. Kunkel, 1967. Forty species of ferns cultivated in the Canary Islands are described, together with up-to-date sections on nomenclature, classification, vernacular names, pests and treatment, and an illustrated glossary of terms and a bibliography. The 43 photographs and numerous line-drawings assist the disadvantage of unconversancy with Spanish. All the species dealt with are familiar in cultivation or native in Britain. The book costs 250 pesetas (32/-) from the author, Camino Viejo 9, Tafira Alta, Las Palmas de Gran Canaria, or from the publishers (Cabildo Insular de Gran Canaria).

J. A. CRABBE

NOTES, NEWS AND ABSTRACTS

A SHELTER FOR SMALL FERNS IN POTS

I have achieved great success with two shelters like the one described, and at present have the following ferns all healthy and flourishing in them: *Adiantum pedatum* var. *aleuticum*, *Asplenium adiantum-nigrum*, *A.a.*'Variegata', *A.* × *alternifolium*, *A. fontanum*, *A.f.* var. *halleri*, *A. macedonicum*, *A.* × *murbeckii*, *A. ruta-muraria*, *A. septentrionale*, *A. trichomanes*, *A.t.* 'Cristata', *A.t.* 'Incisum Moulei', *A. viride*, *A.v.* 'Imbricatum', *A.v.* 'Multifidum', *Blechnum penna-marina*, *B.p.* 'Cristata', *Ceterach officinarum*, *Cystopteris alpina*, *C. dickieana*, *C. fragilis*, *C.f.* 'Cristata', *C. montana*, *Woodsia ilvensis*.

The first thing you need is a container. A strong wooden box would do, provided it is no less than eight inches deep. One of mine is a disused teak washing-up sink which came from the local hotel, the other I constructed myself out of three-quarter-inch boards from an engine packing-case obtained from a local garage. Having got your container, bore a few drainage holes which are covered by pieces of perforated zinc. The next things needed are four upright pieces of wood, one at each corner of the container, the front ones standing fifteen inches and the back ones twelve inches above the edge of the container, thus giving fall for the roof. Cross-pieces are fixed at the front, back, and ends. The ends and back can be filled in with perforated zinc. The roof is composed of wood slats with a half-inch gap between each one, thus letting rain through and also providing shade. The container, the size of which is ruled by how many pots you wish it to hold, is now ready for setting up. Put a layer of sand on the bottom. The pots are now placed on the sand so that their rims are about level with the edge of the container. It is essential that clay (not plastic) pots are used. Pack the pots round and in between with some water-retentive material such as sphagnum moss or peat or vermiculite. Thus, the packing keeps the walls of the pots damp and the sand provides drainage. The potting compost I use is one part each of the following: fibrous loam, leaf-mould, peat, fine scree or sand; plus a handful or so of bone-meal for every cubic foot. For *Asplenium trichomanes*, *A. ruta-muraria* and *Ceterach* a handful or two of crushed mortar is helpful but not essential.

FRED JACKSON

Knotts View, Stonethwaite, Cumberland

FERN CLASSES AT SOUTHPORT FLOWER SHOW

24–26 AUGUST 1966

In 1966 three new classes (13 and 16 for foreign hardy ferns, and 11 for a smaller ground group) were introduced to encourage more exhibitors and to widen the opportunities, but there were only one or two entries for them. In conversation with members manning the Society's advice

bureau, it was mentioned that transport difficulties were an important factor for many potential exhibitors.

Mr Brookfield's ground group (Class 10) was a memorable and expert arrangement of many beautiful specimens and rare varieties in top condition. Mr Hayhurst's smaller ground group (Class 11) was also a fine exhibit. In view of the particularly handsome prize money for Classes 10 and 11, we felt bound to set a very high standard which resulted in there being only one other award.

We recognised several old friends amongst the plants exhibited, but would like to see much more competition. Even though it may be difficult to compete with wonderful specimens of many years' growth, it often happens that perfectly grown smaller specimens can score over larger plants not quite at their best.

R. KAYE & W. G. MACKENZIE, Judges

PRIZEWINNERS AND THEIR ENTRIES

CLASS 10 A group of hardy British ferns, with accent on diversity of species and variation, arranged in a natural manner in a space 13 feet by 8 feet and not higher than 6 feet above the ground:

1st Messrs J. Brookfield & Son who continue to hold the Silver Perpetual Challenge Trophy presented by the British Pteridological Society.

CLASS 11 A display of not more than 20 diverse hardy British ferns, in a space not exceeding 8 feet by 5 feet:

1st B. Hayhurst

2nd Messrs Brookfield

CLASS 12 Six dissimilar hardy British ferns with accent on variation:

1st Messrs Brookfield: *Athyrium filix-femina* 'Congestum Paul', *Dryopteris filix-mas* 'Askewii', *Phyllitis scolopendrium* 'Crispa', *Polypodium vulgare* 'Hadwinii', *Polystichum aculeatum* 'Pulcherrimum Bevis', *P. setiferum* 'Divisilobum'

2nd B. Hayhurst: *Athyrium filix-femina* 'Percristatum', *Dryopteris filix-mas* 'Angustata Crispa Cristata', *D. dilatata* 'Succisa', *Phyllitis scolopendrium* 'Ramo-marginata', *Polypodium vulgare* 'Pulcherrimum', *Polystichum setiferum* 'Iveryanum

CLASS 13 Six foreign ferns hardy in Great Britain:

1st B. Hayhurst: *Adiantum pedatum* var *aleuticum*, *A. venustum*, *Blechnum tabulare*, *Onoclea sensibilis*, *Phymatodes diversifolia*, *Polystichum acrostichoides*

CLASS 14 Six dissimilar greenhouse ferns:

1st Messrs Brookfield: *Adiantum cuneatum* 'Kensington Gem', *Cyrtomium falcatum*, *Microlepia hirta*, *Platycerium alcicorne*, *Polypodium aureum*, *Pteris cretica* 'Wimsetti'

equal 1st B. Hayhurst: *Adiantum cuneatum* 'Kensington Gem', *A. cuneatum*, *Davallia bullata*, *Nephrolepis* 'Rosea', *N. exaltata*, *Platycerium alcicorne*

CLASS 15 Three distinct normal species of hardy British ferns:

1st Messrs Brookfield: *Adiantum capillus-veneris*, *Asplenium trichomanes*, *Thelypteris phegopteris*

2nd N. Robinson: *Cystopteris fragilis*, *Gymnocarpium dryopteris*, *Polypodium vulgare*

CLASS 16 Three foreign ferns hardy in Great Britain:

1st B. Hayhurst: *Asplenium adiantum-nigrum* 'Himalaya', *Dryopteris wallichiana*, *Matteuccia struthiopteris*

3rd Messrs Brookfield: *Adiantum venustum*, *Matteuccia struthiopteris*, *Onoclea sensibilis*

CLASS 17 Three distinct varieties of *Phyllitis scolopendrium:*
1st Messrs Brookfield: 'Crispa', 'Ramo-cristata', 'Ramosum'
2nd B. Hayhurst: 'Drummondii', 'Ramo-cristata', 'Ramo-marginata'
3rd N. Robinson: 'Crispa', 'Marginata', 'Marginata Cristata'

CLASS 18 Three distinct varieties of *Polypodium vulgare:*
1st Messrs Brookfield: 'Cornubiense', 'Hadwinii', 'Pulcherrimum'
2nd B. Hayhurst: 'Grandiceps Cowan', 'Hadwinii', 'Pulcherrimum'
3rd N. Robinson: 'Longicaudatum', 'Prestonii', 'Pulcherrimum'

CLASS 19 Three distinct varieties of *Polystichum:*
1st Messrs Brookfield: *P. aculeatum* 'Gracillimum', *P.a.* 'Pulcherrimum Bevis', *P. setiferum* 'Wakeleyanum'
2nd N. Robinson: *P. setiferum* 'Cristatum', *P.s.* 'Divisilobum Densum', *P.s.* 'Divisilobum Iveryanum'
3rd B. Hayhurst: *P. aculeatum* 'Pulcherrimum Bevis', *P. setiferum* 'Cristatum', *P.s.* 'Imbricatum Cristatum'

CLASS 20 Three distinct varieties of *Athyrium filix-femina:*
1st Messrs Brookfield: 'Clarissima', 'Congestum Paul', 'Plumosum Cristatum'
2nd B. Hayhurst: 'Clarissima Jones', 'Cruciatum Cristatum', 'Frizelliae Capitatum'

CLASS 21 Three distinct varieties of *Dryopteris:*
1st B. Hayhurst: *D. borreri* 'Augustata Cristata', *D. dilatata* 'Succisa', *D. filix-mas* 'Depauperata Cristata'
2nd Messrs Brookfield: *D. filix-mas* 'Askewii', *D.f.* 'Fluctuosa Cristata', *D.f.* 'Linearis Cristata'
3rd N. Robinson: *D. borreri* 'Ramosissima', *D. filix-mas* 'Depauperata Cristata', *D.f.* 'Fluctuosa Cristata'

CLASS 22 Three *Gymnocarpium* or *Thelypteris:*
(one entry, no award)

CLASS 23 Three distinct varieties or species of *Asplenium:*
1st Messrs Brookfield: *A. adiantum-nigrum, A. ceterach, A. ruta-muraria*

CLASS 24 One British fern of any kind or variety:
1st Messrs Brookfield: *Adiantum capillus-veneris*
2nd B. Hayhurst: *Athyrium filix-femina* 'Victoriae'

CLASS 25 One greenhouse fern:
1st B. Hayhurst: *Adiantum cuneatum* 'Kensington Gem'
2nd Messrs Brookfield: *Adiantum cuneatum* 'Kensington Gem'
3rd W. M. Howarth: *Adiantum cuneatum*

N. ROBINSON

RESYNTHESIZING *ASPLENIUM ADULTERINUM*

Dr. J. D. Lovis writes that he has at last succeeded in resynthesizing the above species from its parents, *A. viride* and *A. trichomanes* ssp. *trichomanes*. Because of a misunderstanding, an erroneous report that Lovis had succeeded in precisely this synthesis was published in the *Gazette* a few years ago (1955, Vol. 8: 127), but was corrected by himself in a subsequent issue (1957, Vol. 8: 182). Now, however, Lovis states that he has finally put the record straight by in fact achieving this synthesis. He believes this to be the first time that a natural fern species has been reconstructed in this way. Further details are promised for inclusion in a future part of the *Gazette*.

ASPLENOPHYLLITIS MICRODON REFOUND

Mr P. J. Girard has written from Guernsey, sending us photographs of this species (cf. *Brit. Fern Gaz.*, 9:35. 1961), which he has recently rediscovered in the island. We hope to publish a paper on this discovery in the next issue of the *Gazette*.

ABSTRACTS

Further work on evolutionary aspects in *Asplenium* is continuing at Leeds University. LOVIS, MELZER & REICHSTEIN report (Bauhinia **3**:87-101. 1966) the hybrid *Asplenium lepidum* × *A. trichomanes* subsp. *quadrivalens* which they name *A.* × *aprutianum*; the holotype, collected by H. Kunz & T. Reichstein (TR700) in Abruzzo, Italy, is in cultivation and a herbarium specimen is in BM. Previous to this (Bauhinia **2**:231-237. 1965) these three authors had described *A.* × *adulteriniforme* (*A. trichomanes* subsp. *trichomanes* × *A. viride*) collected by H. Malzer near Gutenstein, Niederösterreich; again the holotype is in cultivation and a specimen is in Herb. BM. E. ATTINGER (Ber. Schweiz. Bot. Ges. **75**:92-95. 1965) collected and described a further hybrid *A.* × *valgannense* (*A. seelosii* × *A. trichomanes* subsp. *quadrivalens*) from Varese, Italy; the holotype is deposited at Zürich (ZT).

Contributions to the study of *Dryopteris assimilis* have come from W. GATZI (Ber. Schweiz. Bot. Ges. **76**:146-156. 1966) reporting on Swiss populations, and from A. & D. LÖVE (Flora, J. Icelandic Bot. **4**:5-9. 1966) confirming the diploid in Iceland. J. A. NANNFELDT (Bot. Not. **119**:136-152. 1966) gives a dot map of the distribution of the species in Sweden. R. H. ROBERTS (Nature in Wales **9**:162-164. 1966) confirms the count of n = 41 in N. Wales material. T. SIMON & G. VIDA (Ann. Univ. Sci. Budapest Rolando Eötvös (Biol.) **8**:275-284. 1966; in German with Russian summary) give an account of *D. assimilis* in Europe with a dot map; the record for Eire is doubtful (Vida pers. comm.) and is based on the length of the lower basiscopic pinnule only. C.-J. WIDÉN & V. SORSA (Hereditas **56**:377-381. 1966) report preliminary chromatographic investigation into four members of the *Dryopteris* "*spinulosa*" complex, including *D. assimilis*. R. M. TRYON & D. M. BRITTON (Rhodora **68**:59-92. 1966) give a thorough appraisal of the variation of the cytotypes of *D. spinulosa* (*carthusiana*) showing by silhouette the range of frond shape and dissection. D. M. BRITTON & J. H. SOPER (Canad. J. Bot. **44**:63-78. 1966) give the distribution of *Dryopteris* species in Ontario, pointing out that all the *D.* "*dilatata*" is diploid, possible conspecific with *D. assimilis*.

G. BENL is continuing his studies on the fern flora of Macaronesia: Nova Hedwigia **12**:137-148. 1966 (*Cheilanthes*), Mitt. Bot. Staatssamm. München **6**:33-45. 1966 (*Cheilanthes* and *Cystopteris*), Cuadernos de Botanica **1**:25-28. 1967 (*Hymenophyllum tunbrigense*). G. KUNKEL (Cuadernos de Botanica **1**:29-34. 1967) gives a useful bibliography of recent works on the botany of the Canary Islands.

The generic name *Gymnocarpium* was decided on a vote by the General Committee of I.A.P.T. to be illegitimate (R. ROSS in Taxon **15**:287. 1966). A. & D. LÖVE (Univ. Colorado Stud. (Biol.) **24**:8. 1966) proposed a nomen novum, *Carpogymnia*, to replace it.

A. LÖVE & B. M. KAPOOR (Nucleus **9**:132-138. 1966) give a chromosome count for *Ophioglossum azoricum* (*O. vulgatum* subsp. *ambiguum*) from Iceland as n = c. 360 and suggest it is an alloploid derived from an occasional hybrid between *O. lusitanicum* and *O. vulgatum*.

A. C. JERMY

REVIEWS

THE ILLUSTRATED FLORA OF ILLINOIS: FERNS by R. H. Mohlenbrock, xv+191 pages, 15×22 cm: Carbondale and Dewardsville: Southern Illinois University Press: London and Amsterdam: Feffer & Simons Inc, 1967. $8.00.

The ferns and "allies" have always made a convenient unit for monographing on a regional basis and the 81 species and 6 lesser taxa treated in this attractive volume are no exception. It is interesting to note that during the research for the preparation for the volume 13 additional species were added to the Illinois list.

There is a most useful key to the 28 genera described (including all British genera except *Hymenophyllum*) based solely on vegetation characters, with thumbnail sketches in the margins to help the descriptive text. Each species is illustrated with a neatly executed, accurate full-page line drawing. Common names, synonymy, geographic range and habitat given are valuable, and the author's field or other notes either elucidate or summarize the present taxonomy of the species under discussion. He gives chromosome numbers for some species, but unfortunately does not always give the source of his information. He describes a new variety, *Lycopodium lucidulum* var. *tryonii*, on p. 26.

This is an up-to-date account of a good cross-section of N. American ferns and well worth buying if one is at all interested in temperate ferns.

FERNS AND FERN ALLIES OF CALIFORNIA by Steve J. Grillos, illustrated by Rita Whitmore, 104 pp. 11×18.4 cm: University of California Press, Berkeley, 1966. $1.50.

This is another of the more recent State Floras to be produced covering an interesting region of the U.S.A. Sixty-four of the eighty-seven Californian ferns are fully described, the remainder being mentioned with their distribution in California. The commoner fifty-five species are illustrated, often as thumbnail sketches which are very effective although not so successful with the larger species e.g. *Dryopteris* and *Polystichum*. The keys are good and easy to use. The descriptions, unfortunately, are not standardised and important characters such as whether the rhizome is erect or creeping are often omitted; others are included twice both in the generic description and in that of the species. In *Equisetum telmateia* var. *braunii* sterile stems are given as "white or pale green"; in fact this variety is distinguished by the stomata on the greenish sterile stem and I have never seen in N. American plants the ivory white stems so characteristic of our European *E. telmateia*; I suspect Mr Grillos is compromising between his own experience and the descriptions in earlier literature. For just over 10s. this little book is certainly worth buying.

A. C. JERMY

OBITUARIES

EDMUND FREDERIC WARBURG

Dr Warburg, an Honorary Member, died at the age of 58 on 9 June 1966; he was born on 22 March 1908. He was a product of Cambridge and his first appointment away from there was at Bedford College, London, but the war found him interpreting aerial photographs in the R.A.F. In 1945

he was invited to join the staff of the Department of Botany at Oxford, as Curator of the Druce Herbarium, later as lecturer and in 1964, a Reader.

Heff, as he was known to his friends and the botanical fraternity at large, is best known for his part in Clapham, Tutin and Warburg, *Flora of the British Isles*, and in particular, amongst other families for which he will be long remembered, e.g. Rosaceae, he was responsible for writing up the Pteridophyta. His approach was singularly one of practicability; he disliked making two genera out of one, e.g. in recognising *Gymnocarpium* apart from *Thelypteris*, when on the face of it they are so similar. Likewise with latin names he was adamant in refusing to accept Alston's revival of *lanceolato-cristata* for such a well known plant as *Dyopteris spinulosa* on the grounds that it was cumbersome and a change for the worse. He had seen so many name-changes in the British Flora, not only in vascular plants but also in mosses, which became perhaps, his main interest in latter years, that the wisdom of this refusal is easy to understand. Warburg was the President of the Botanical Society of the British Isles at the time of his death and believed sincerely in the part that such Societies as ours can do to foster interest in botany.

GARETH BEVAN EVANS

On 1 October 1966 *The Times* reported that Dr G. B. Evans had been found dead in his room in the University of Malaya, Kuala Lumpur. He had been a lecturer in botany at that University since January 1965.

Gareth was born in Cadoxton, Glam. on 3 September 1935, the only son of Mr and Mrs D. G. Evans. After attending Neath G.S., he served his National Service in the R.A.S.C. and went up to Trinity College, Cambridge in October 1956. On graduating in 1960 he had been accepted by the University College of N. Wales, Bangor, to study under Professor P. W. Richards. Although his subject was the autecology of the British *Hymenophyllum* species for which he was awarded a PhD of the University of Wales in 1964, discussions at Bangor stimulated an interest in tropical botany. In 1961 he went on a student expedition to Morabali Creek, British Guiana, and again in 1963 he led another party to do statistical ecology in the same area. In the intervening year he had joined an Oxford expedition to the Cameroons where he collected further data for a statistical analysis of the tropical rain forest. His interest in filmy ferns was always to the fore and he made specialist collections in Africa, B. G. and in Malaya where he was working on their physiology. Unfortunately his life as a teacher had only just begun, but he had gained a respect from his students and inspired perhaps more than a few to look more deeply into a plant's reaction to its own environment.

A. C. JERMY

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THE

BRITISH FERN GAZETTE

VOL. 9 PART 8 1967

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